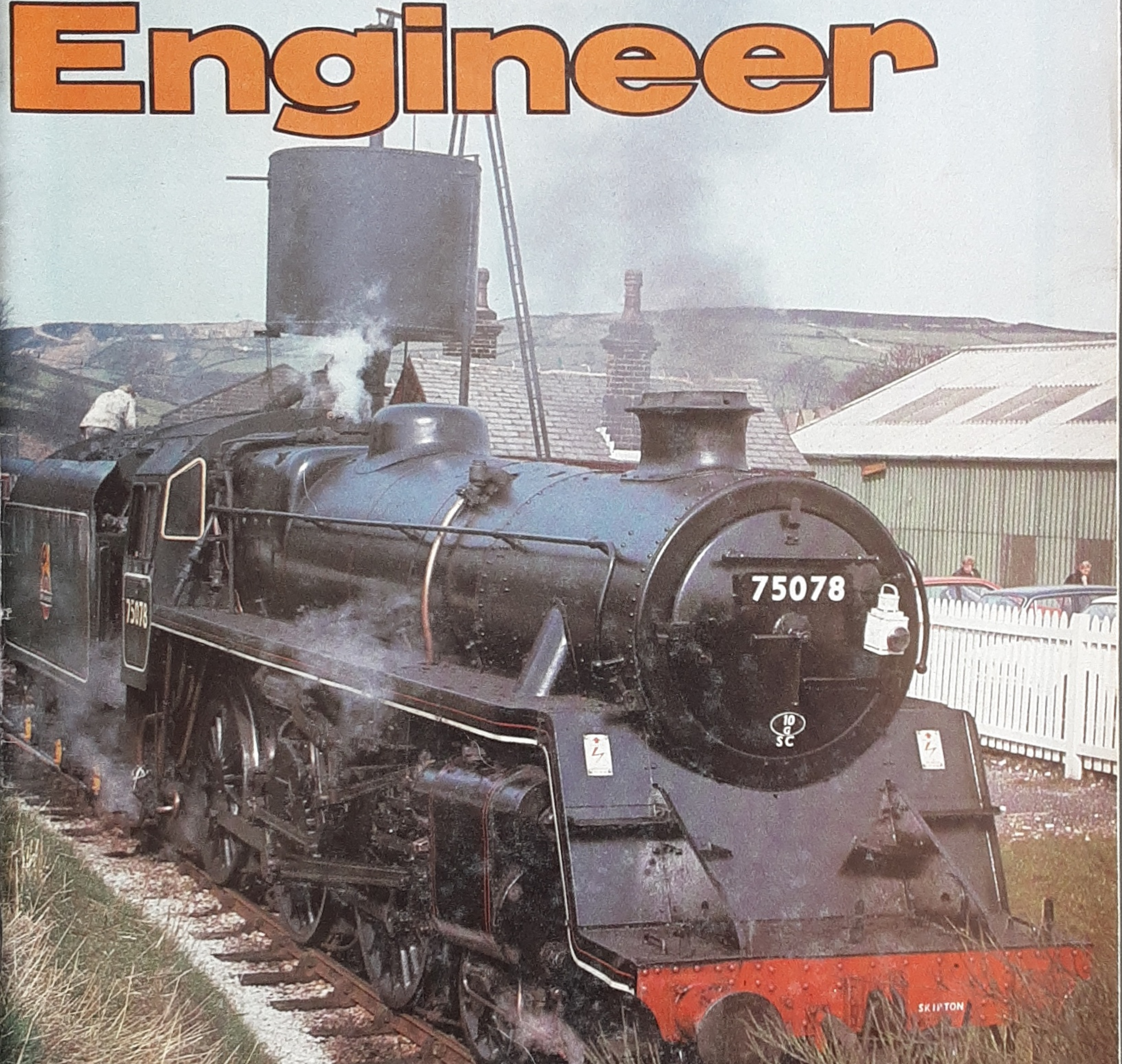
7-20 July 1978 First and Third Friday Volume 144 Number 3588 40p

(USA & CANADA —$1.75)

Model Engineer

MAP

HOBBY MAGAZINE



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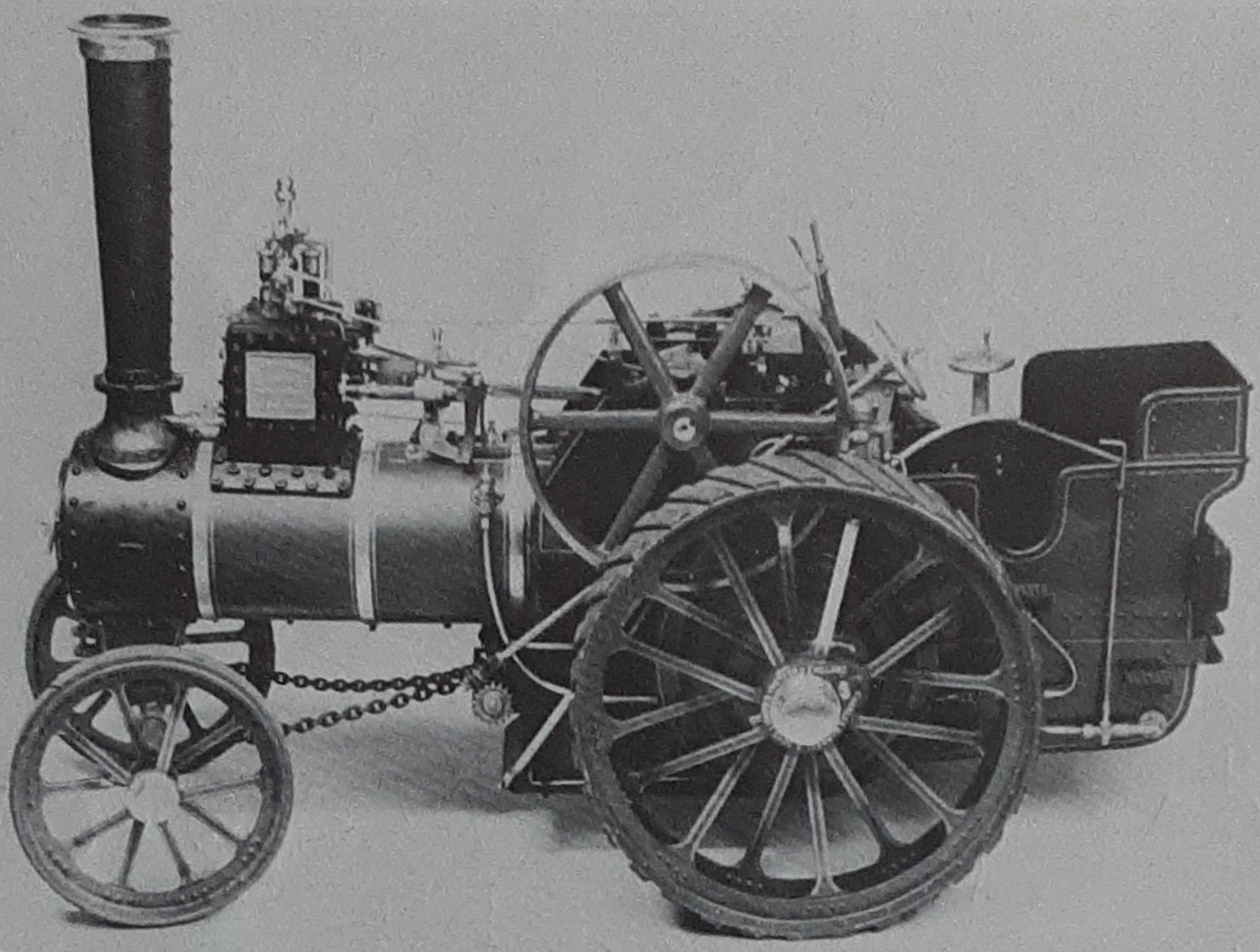

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7 July 1978

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Enquiries regarding Hobby Shop Sales to Bill Dean Books Ltd., 166-41, Powell's Cove Boulevard, Whitestone, New York 11357, U.S.A. Telephone: (212) 767-6632.

Model & Allied Publications Ltd

Editorial and Advertisement Offices:

P.O. Box 35
Hemel Hempstead
Herts, HP1 1EE

Tel: Hemel Hempstead
Editorial 41224
Advertising 42501/2/3

B.R. Standard Class 4, 4-6-0 loco seen at Oxenhope Station on the Worth Valley Railway. Photo by Clifford Robinson.

NEXT ISSUE

Robin Dyer's Clayton Undertype Wagon.

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The Editor is pleased to consider contributions for publication in "Model Engineer". Manuscripts should be accompanied if possible by illustrations and should also have a stamped addressed envelope for their return if unsuitable. While every care is taken, no responsibility can be accepted for unsolicited manuscripts, photographs, art work, etc.

Subscription department:
Remittances to **Model & Allied Publications Ltd.**, P.O. Box 35, Hemel Hempstead, Herts. HP1 1EE (Subscription Queries Tel: 0442 51740). Subscription Rate £13.00, Overseas Sterling £13.00, U.S.A. and Canada $25.00, 1st Class Airmail $64.00. Annual Subscription includes a copy of the Model Engineer Exhibition Guide published in mid-December and the Annual Index.

Also published by MAP: Aeromodeller; Model Boats; Radio Control Models & Electronics; Model Railways; Scale Models; Military Modelling; Woodworker; Battle.

ABC
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Model Engineer is printed in Great Britain by Blackfriars Press Ltd., Leicester, for the proprietors and publishers, Model & Allied Publications Ltd. (a member of the Argus Press Group), 13/35 Bridge Street, Hemel Hempstead, Herts. Trade sales by Argus Distribution Ltd., 12/18 Paul Street, London, E.C.2, to whom all trade enquiries should be addressed.

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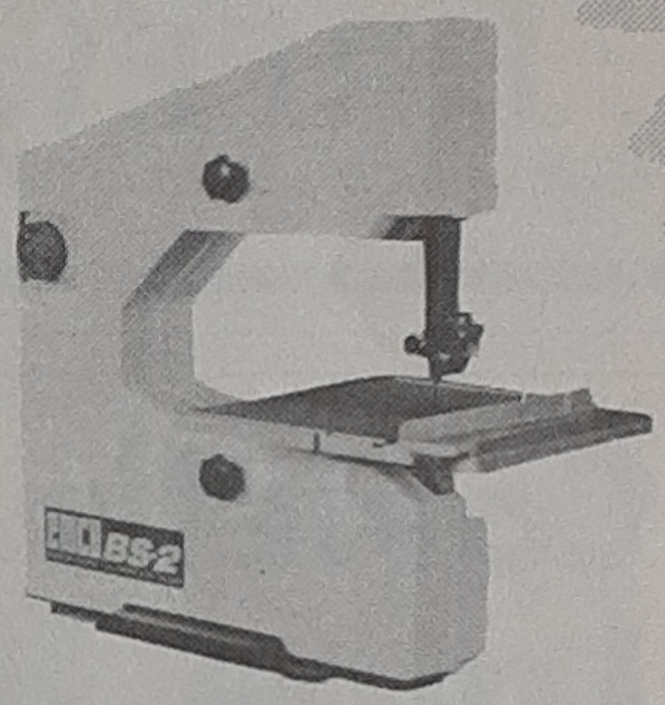

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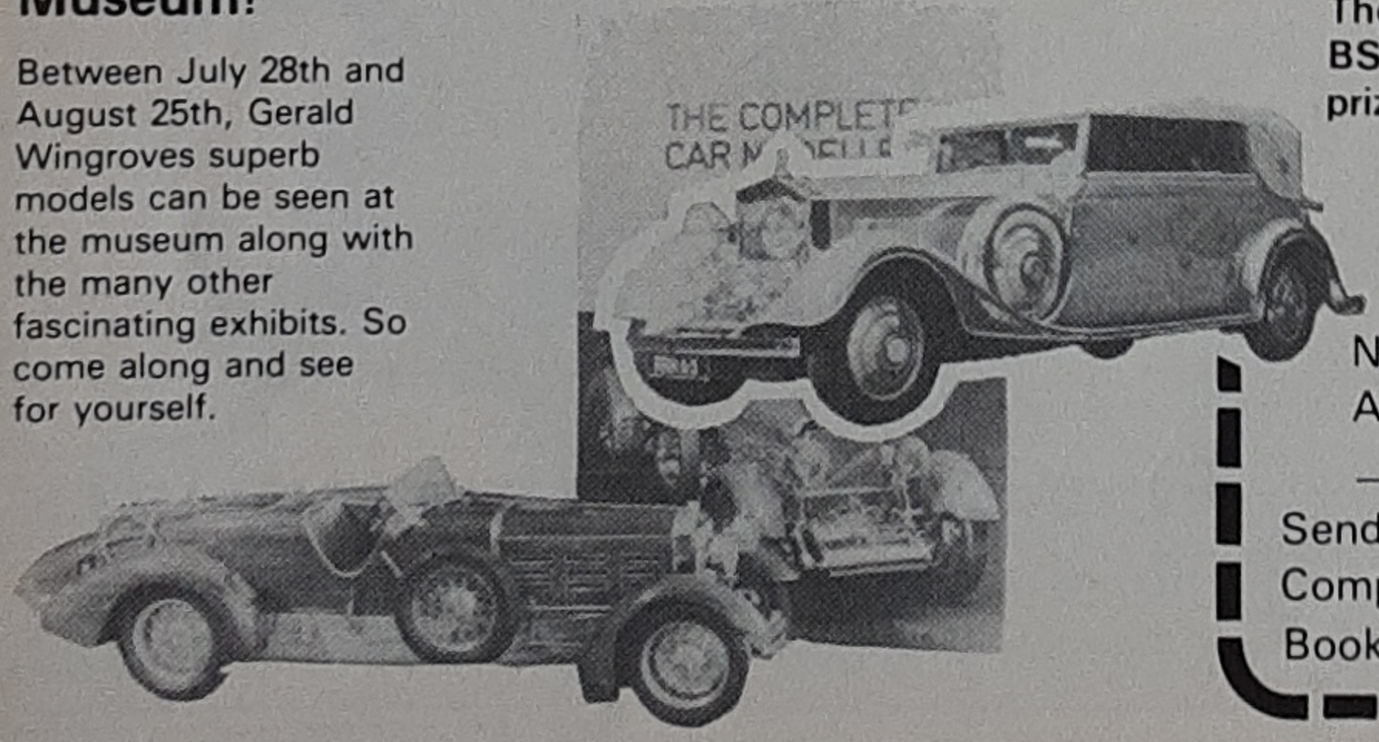

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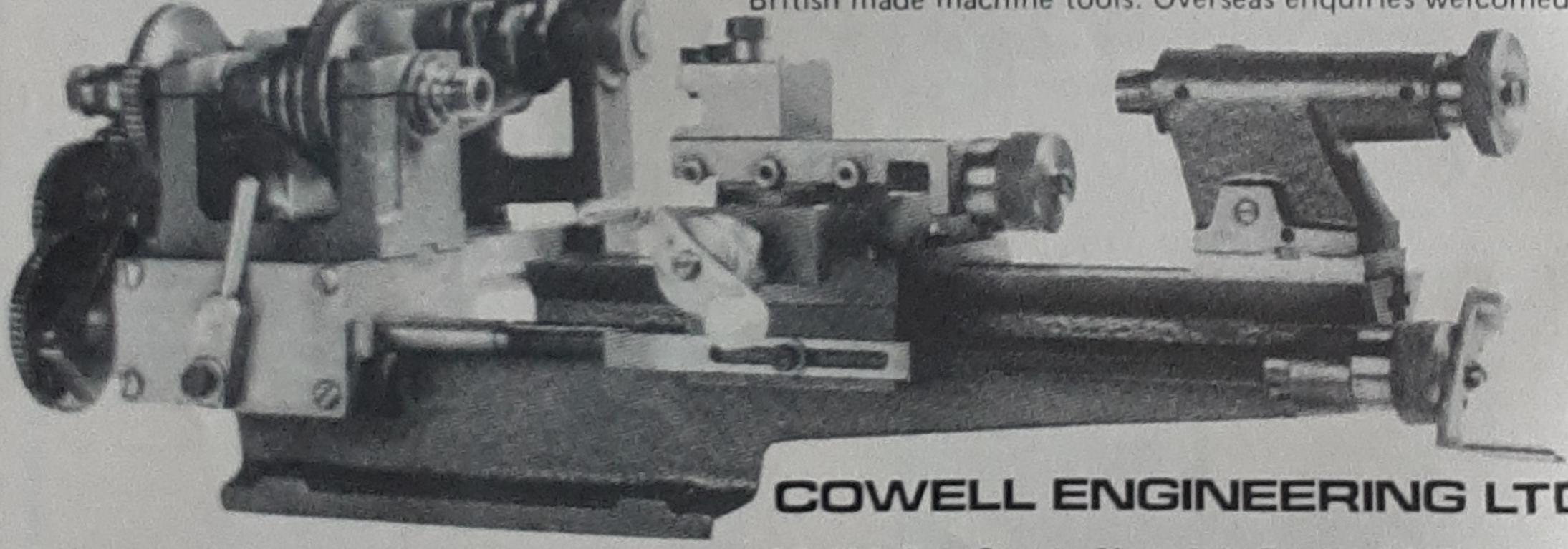

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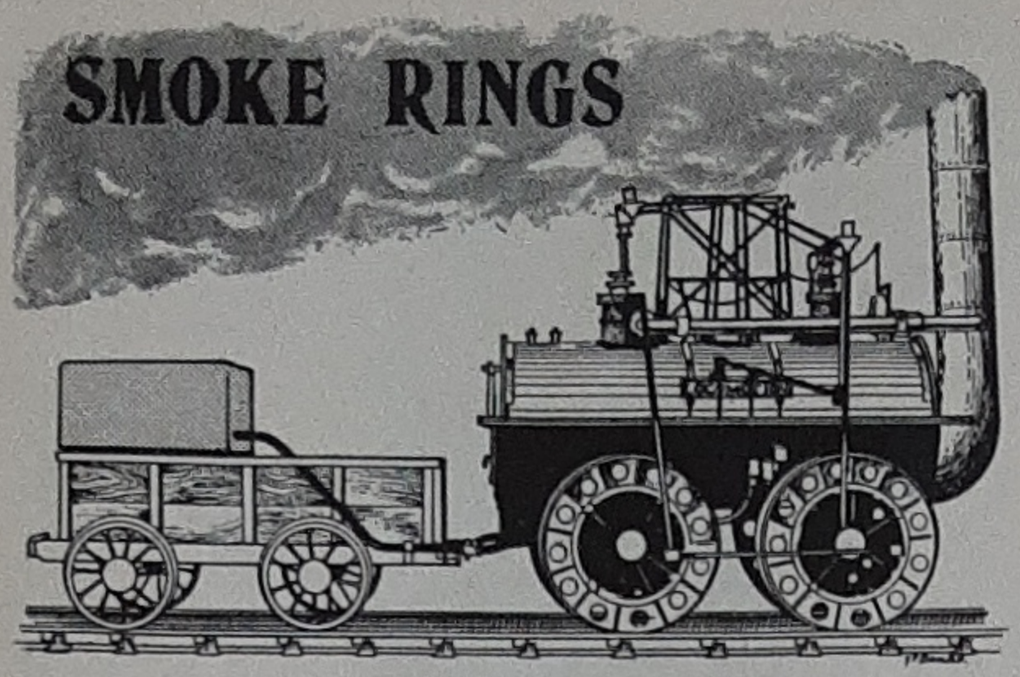


A Commentary by the Editor

A note for next January

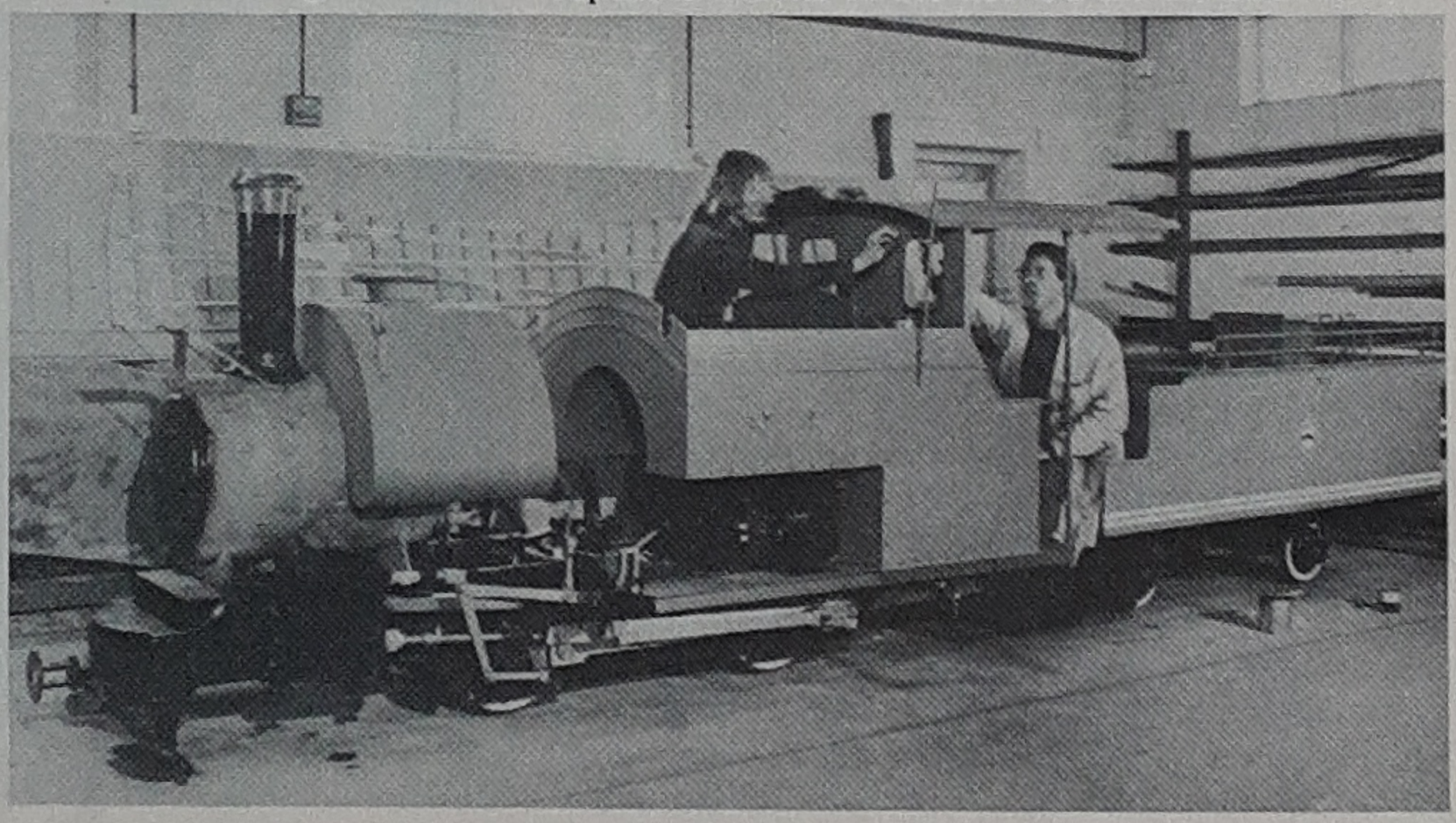
Visitors to next year's Model Engineer Exhibition will be interested to note that the former Wembley Hill station has been renamed to Wembley Complex. The re-opening ceremony was performed by Sir Henry Marking, chairman of the British Tourist Authority, on 9 May and he, along with about 150 others, travelled from Marylebone Station using the new Quick Link service in ten minutes.

New from Milner

We have featured the products of Milner Engineering Chester Ltd. in these pages before but I think this new project certainly deserves a look-in. It is a 7 in. to 1 ft. scale replica of a coal fired Darjeeling Himalaya Mountain Railway loco designed for the new tourist railway at Mur de Bretagne in Brittany. It will run through five miles of scenic France on the old trackbed of the Narrow Gauge Reseau Breton, Carhaix. The model is 20 ft. long, 3 ft. 4 in. wide and 5 ft. high, weighs 3½ tons with tender and will haul up to 25 tons on the level at 15 m.p.h. The finish is in the Indian North Frontier Railway livery of blue and black with white lining.

The SS 'Great Britain'

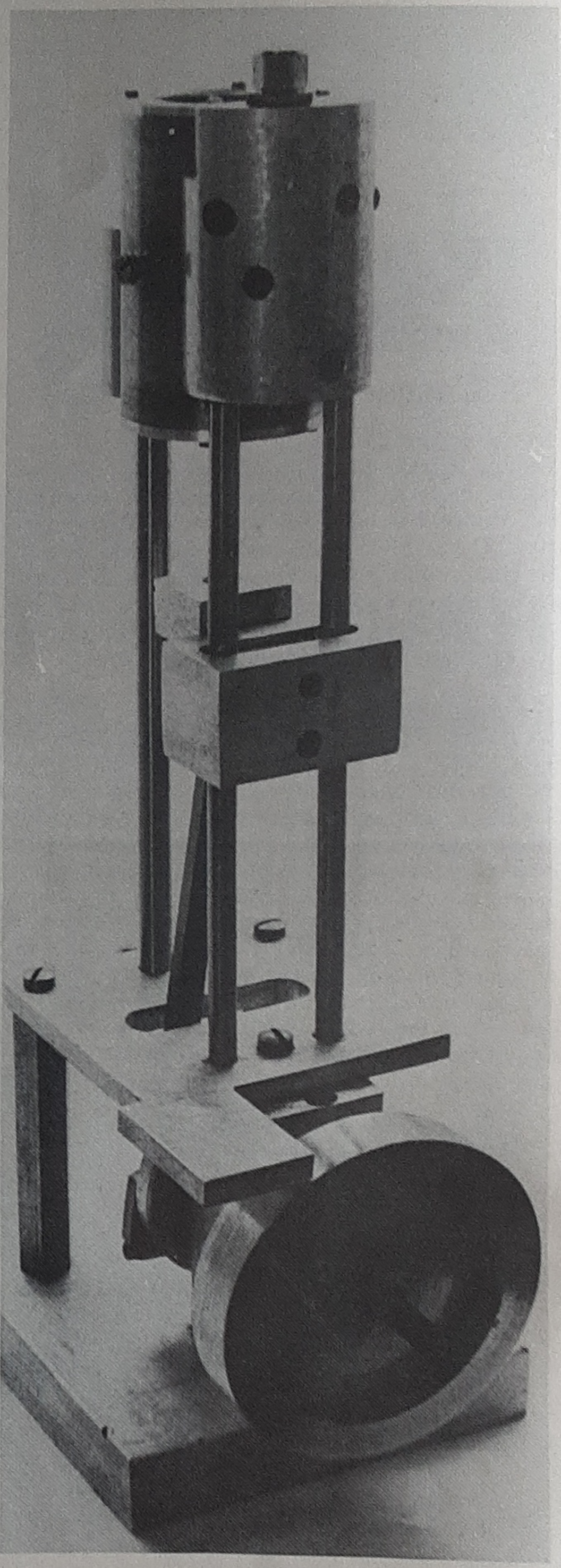
How much do you know of this famous ship? I haven't yet had the opportunity to visit her at Bristol's Great Western Dock and the information has up to now come from newspapers. There is, however, a very informative press release just arrived from Hamworthy Engineering Ltd. of Poole, in which quite a bit of the vessel's history is published. Briefly, the ship was the first ocean-going vessel to be propeller driven and built in iron. She was 1930 DWT and displaced 3675 tons fully laden. On her first trip to New York from Liverpool, she did the journey in 15 days and afterwards went on to the Australia run where she did 32 trips at an average of 60 days per trip. She carried gold rush emigrants and also the first England cricket team to visit that country. In the Crimean War she was a troop ship. In 1886 she rounded Cape Horn in violent weather and was so damaged that she was left in the Falkland Islands. What about her engines? The original disappeared in 1850 after a grounding on the Irish coast, the replacement also vanished in 1882 when she was converted to sail only. The engines were based on Marc Brunel's design (he was the father of Isambard) for a paddle engine. The engine weighed 340 tons and had four cylinders, 7 ft. 4 in. in diameter with a 6 ft. stroke to an overhead crankshaft. Isambard Brunel had to turn the engine through 90° to drive a propeller shaft and gear the 18 ft. diameter drive wheel by chain so that the revs increased from 18 to 53 r.p.m. The 34 ft. long boiler raised 6 p.s.i. All this leads up to the fact that Hamworthy Engineering has been commissioned to build a one-tenth scale model of the engine for display alongside the vessel at Bristol. With the research into the original engine details covering the Science Museum, Great Western Steamship Co., *The Times*, and old technical articles, model engineers should be assured of an exact replica available in the not too distant future.



Milner Engineering's new loco for tourism in France

'VERTIGO'

A valveless column engine described by Rex Tingey



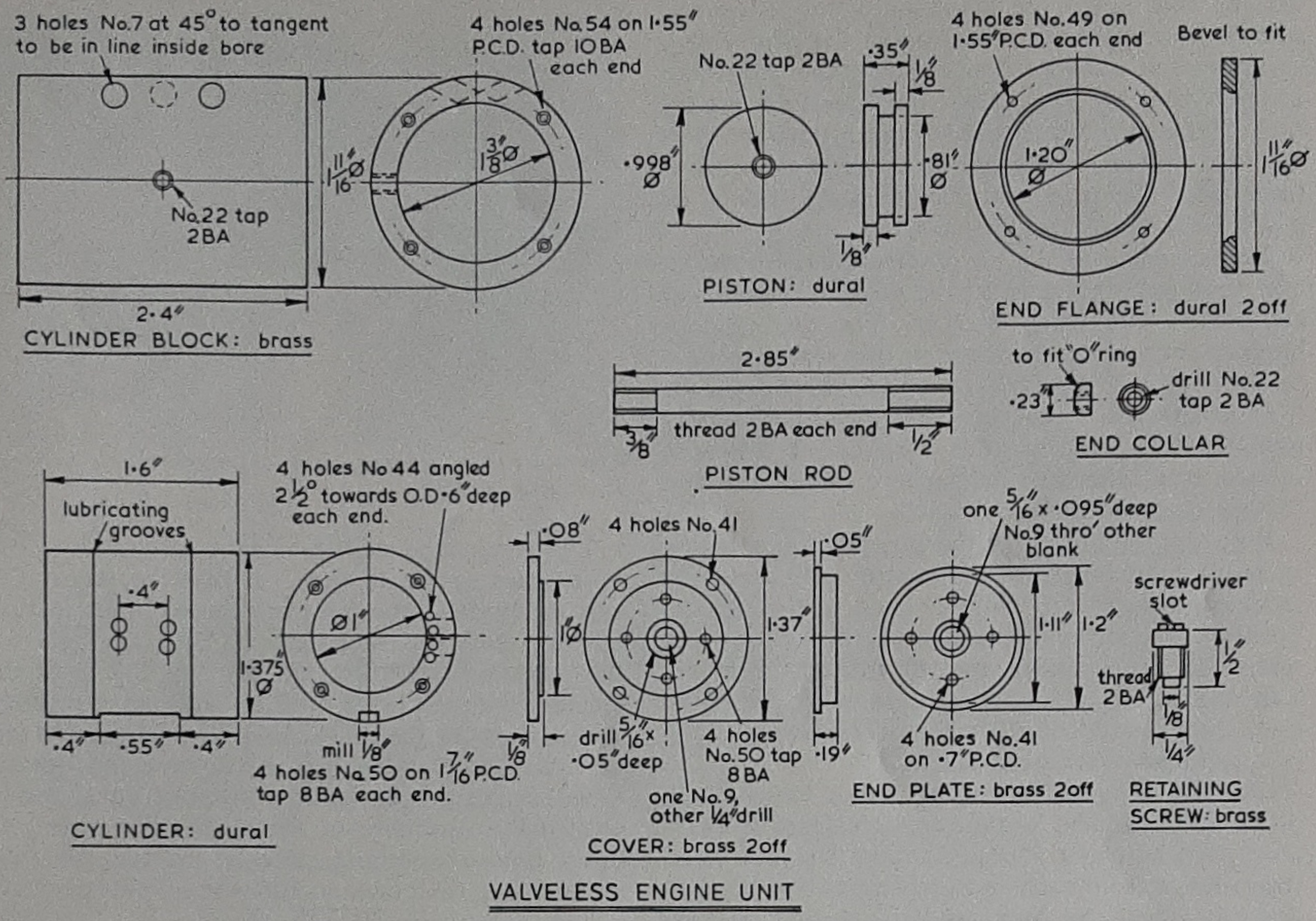
THIS ENGINE WAS built simply because it had been suggested that my valveless engine design would not work properly in a vertical mode in a large size, that the moving cylinder would fall by gravity, and so on. I made *Vertigo* about as big as possible with the Unimat SL, and this version of the engine unit has a 1 in. bore by 1½ in. stroke. The name may be considered as either quite sensible, or as a terrible pun.

In designing this version an attempt was made to adapt the old-type vertical column engine to a modern and utilitarian style, with simplicity of construction. In the construction economy is the keynote, with a deal of thought given to variations in positioning, so that each unit can be made to fit the next with the least bother, even when minor discrepancies occur: the idea being that a beginner could easily make the model.

Holes which have to be parallel are bored out on the lathe, at the centre height of the Unimat. Silver steel is used for the three columns, and two of these double as cross-head guides. Bearings are either ball-races or simple fittings of phosphor bronze. The connecting rod is over three times the length of the stroke to minimise angularity effects. The design is such that the height of the engine can be altered by simply increasing or decreasing the length of the columns, and then making a connecting rod to suit.

The engine is mainly of aluminium alloy for ease of machining, but drilling and tapping need a little care in this material. The only part fabricated in mild steel is the connecting rod and most of the work on this can be carried out on the grinding wheel.

The engine unit is the same valveless design, but with a power stroke of 1.1 in. plus a cylinder movement of 0.4 in. in the block. The cylinder



VALVELESS ENGINE UNIT

block is a sleeve of thick brass tube, with a steam block saddled to fit. The steam block is made to incorporate a displacement lubricator. Lubrication for parts of the motion is by means of wells, or just a squirt from the can.

It should be noted that the overall diameter of the cylinder unit is only 1 11/16 in., so that with the larger piston of 1 in. diameter the additional concentric thickness of the moving cylinder is barely noticeable. Two units of this size as outside cylinders of a small 3½ in. gauge locomotive would look in scale.

The Engine Unit

Being a larger unit the engine requires slightly different methods of machining than the little version. Turn the cylinder from 1½ in. diameter aluminium alloy, boring the hole for the piston by first drilling through, up to about 12 mm., with the metal held in the three-jaw, and at the other end by the three-point steady, with greased points. Then, using a boring tool held in the tool-post on the cross-slide, bore out the first inch to about 0.95 in. so that you can see to bore out the deeper part. When the cut is level all through, reduce the cut to a thou a pass (remember this takes off 2 thou from a bore). Have the vernier calliper set to a couple of thou under the inch, and when the inside jaws can just enter the bore take another cut at around half a thou and pass the boring tool through with a slow feed, bringing it back and passing it through three or four times at this setting, and leave it at that. If you have an inch reamer you may wish to try reaming by hand, but I always manage to score soft alloys with the larger hand reamers, also ending up with a rifled pattern right through. Turn the two ends to the correct length to a finish.

Turn a piece of light alloy, between centres, to just fit the bore, with a little protruding each end. Put the piece carefully into the bore and add two spots of Loctite 641 or 242, diametrically at one end to hold the parts together while turning the outside of the cylinder to fit the inside of the brass tube of the cylinder block. Make the two oiling grooves, and rub down any burrs produced. Drop a few drops of 3-in-1 between the cylinder and core, place over a suitable hole and give the core a swift tap with a hammer, to displace it from the Loctite.

Thread the piston rod in the lathe, 2 BA both ends, starting with the die right open and using lots of RTD tapping compound on the stainless steel. Turn the piston as a blank with one finished end and part off. Put the blank in the three-jaw chuck to drill No. 22 and to tap 2 BA. Clean the

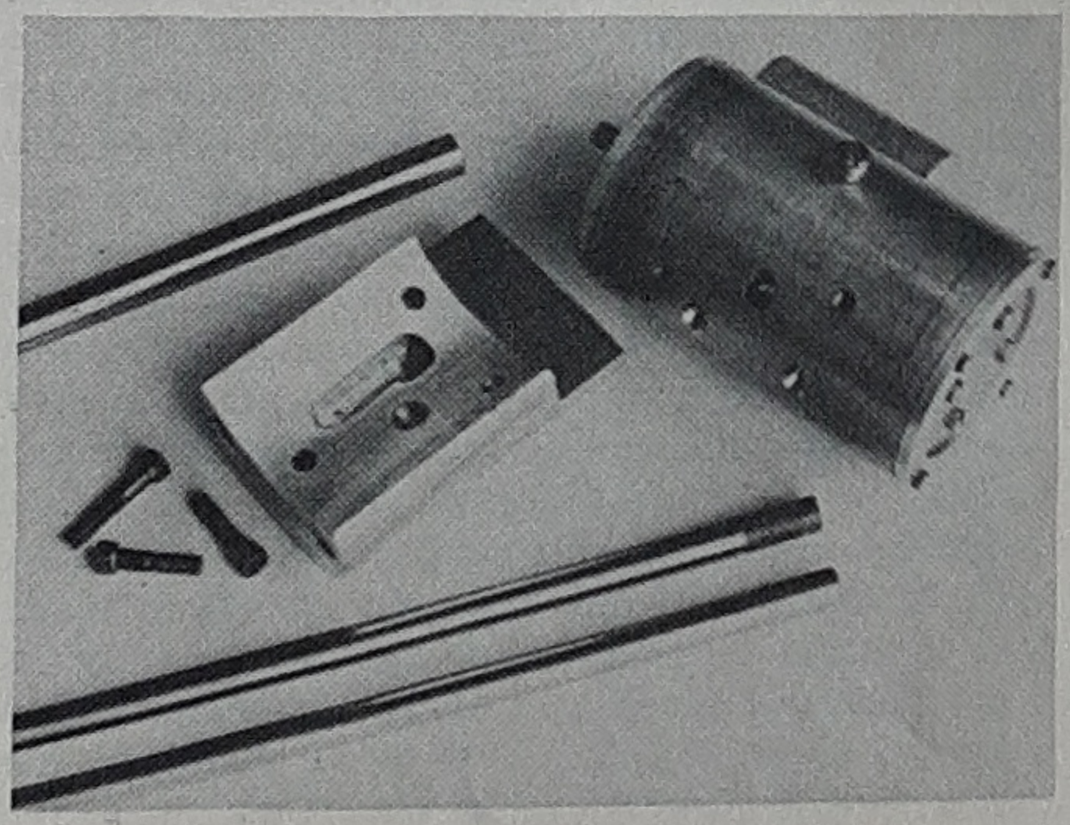
threads and secure the blank onto the piston rod with Loctite 601. Turn the rod in the drill chuck and turn the outside to size, make the groove to fit the Viton "O" ring with a flat ended parting-off tool. Make sure the bottom of the groove matches the final size of whatever the cylinder turned out to be less the ring, and its tolerance should be minimised. Make the end collar.

Turn a piece of 1⅛ in. diameter hard brass in the three-jaw chuck and turn out the covers and end-plates, one after another. For the cylinder block, which is just a sleeve in this case, I used a piece of 1 11/16 in. O.D. by 1⅛ in. I.D. brass tube (this is difficult to obtain, these days) and simply polished it internally after turning off the ends square and relieving the corners. Make the end flanges from dural.

When all the pieces for the engine unit are made, stake out the holes with a centre drill using the indexing attachment, Unimat head in the vertical position, 40-tooth plate in place. Drill for the 8 BA screws in the cylinder and 10 BA in the block. Tap the holes taking great care with the small blind holes, particularly when withdrawing a tap in duralumin after bottoming.

The steam ports have to be drilled to match in block and cylinder. So that enough steam is available, each half of the doubt action has four small steam holes from each end arriving at two holes in the side. Drill the four small holes first, staking with a No. 1 centre drill tip, on the set-up as before, but angled at approximately 2½ degrees from the vertical. The four holes are one tooth of the 40 plate apart. Drill the holes No. 44, withdrawing the drill often in this soft material. The holes should not run together or the drill will break, and can be left this way. The two holes meeting the four are staked in the side with a No. 3 centre drill, and drilled No. 25 to run slightly together; the sharp bits between are removed with a needle file.

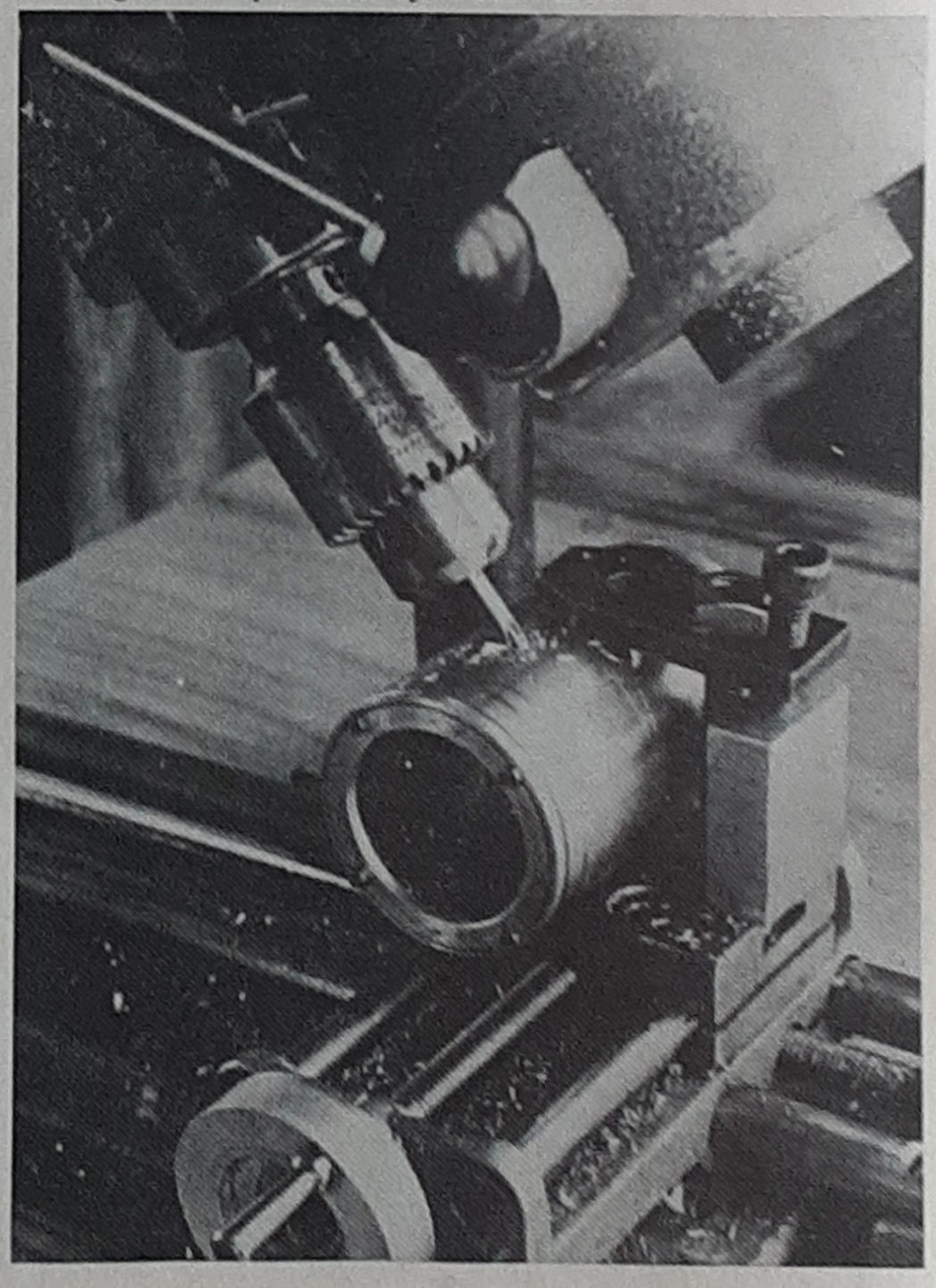
Engine unit and saddled block.

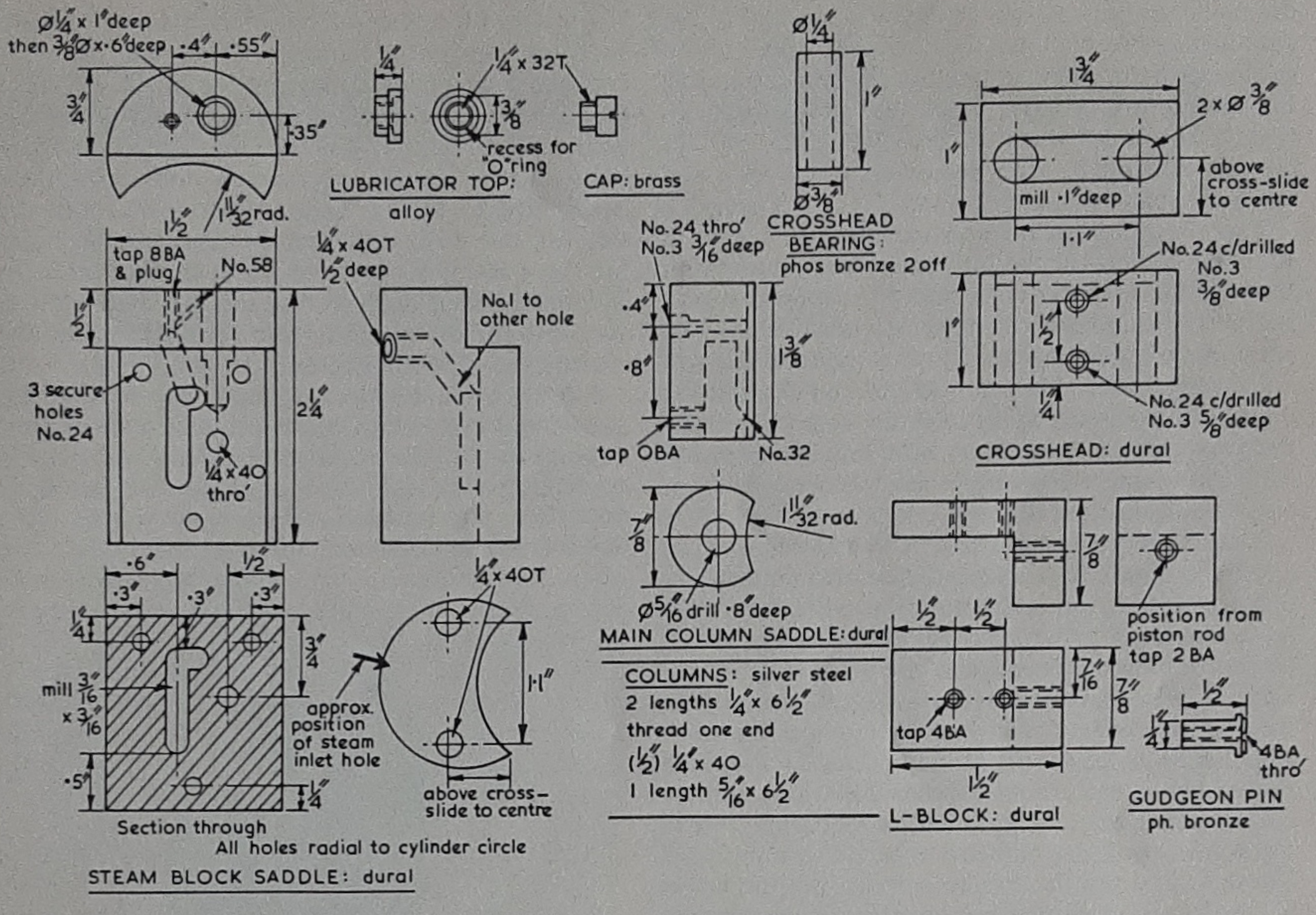


Components – compare size of original unit between block and cylinder.

The brass tube of the block is drilled No. 7 at 45 degrees to the tangent, so that the steam and exhaust holes in the bore are three elipses in line, but are quite separate outside. Drill the hole for the retaining screw No. 22 and tap 2 BA, fit the cylinder with the holes lined up, and mark through the position for the slot to be milled. Make two sets of calico discs and polish the bores using Brasso. It will make this easier if a piece of dural rod is pushed into the bore of the block to remove any burrs before polishing. File a flat for the four steam holes, each end, and file the covers to match.

Drilling steam ports in cylinder block.





Fit the parts together, giving the piston in the bore its "against the light" check, and if all is well, the covers and end plates can be secured in place with Loctite 601 and screws. When cured the cylinder unit can be checked by oiling through the holes until the piston moves freely and, covering them with two fingers, ensuring, thus, that the piston movement does not expel air from any leaks.

Make the retaining screw from $\frac{1}{4}$ in. diameter brass and fit the cylinder to its block, exposing each end to fit the "O" rings so as not to push them past sharp ports. Fit the end flanges and check, by measuring, that the piston travels the full $1\frac{1}{2}$ inches. Adjust the milled slot length, or the bevel of the flanges, whichever is the cause of the short stroke.

Mounting the Engine Unit

The unit is mounted on three columns of silver steel, two of which serve as a crosshead guide, so they must be precisely fitted in their saddled block, which is also the steam block, and contains the lubricator.

This saddle is cut from $1\frac{1}{2}$ in. diameter aluminium alloy, with a flat sawn out from a longer piece than finally required, a further cutaway made down to the limit, and at the end of, the required size of block. This is mounted on the cross-slide and the saddle fly-cut or bored right up to the extra cutaway part. This is working the Unimat to the limit of its flexibility and the result may not fit perfectly, but a certain amount of finishing will be required anyway, with emery cloth wrapped around a circumference, but be careful not to make the curved saddle end up awry. Further corrections can be made for gaps up to about 0.02 in. by the fitting of a paper gasket, epoxy resined into the saddle, the paper wrapped tightly around the cylinder block whilst setting; to finish being Loctited onto the block just the same as a finely machined saddle. This must be carried out after the spare piece has been sawn off and the top, isolated a little for the lubricator section to provide condensation, filed away.

Rub off the two sharp edges of the saddle with emery cloth on a flat surface. Cut a piece of $\frac{1}{8}$ in. mild steel and bolt the saddle, on the mild steel, onto the cross-slide of the Unimat; it will half overhang out the back, two flats down. Bore the two holes for the columns, at centre height, starting with a No. 2 centre drill up to its flutes and finishing, to depth, with a No. 1 drill. Tap the holes in the lathe $\frac{1}{4}$ in. x 40 ME. Cut the silver steel for these columns by cutting a length of $\frac{1}{4}$ in. diameter right in half, thread one end of each.

Drill the other holes and mill the slots to miss the support holes. The chamber for the lubricator can be drilled at centre height. Drill the holes for

the three securing screws in the saddle radial to the cut surface (radial to the cylinder block) and counterdrill the other surface for the hex cap heads. Fit against the cylinder block and mark the position of the holes through, drill the block No. 31 not quite through, after removing the works, and tap 4 BA for the three screws.

Tap the outer steam and exhaust ports $\frac{1}{4}$ in. x 40, make the lid for the lubricator from aluminium alloy, to take the "O" ring and plug, tapped $\frac{1}{4}$ in. x 32 in this case. Fit the top in with Loctite 601, making sure that the little hole is neither filled in nor covered over. This can be checked after fitting the saddle by pouring oil into the steam hole with the cap off the lubricator, and move the piston whilst covering the steam hole, when oil will spit and bubble in the lubricator.

The main column saddle is made from $\frac{7}{8}$ in. diameter aluminium alloy, longer than finally required, turned in the lathe and bored for the 5/16 in. silver steel column, after which the saddle is fly-cut or bored, clamped to the cross-slide of the lathe. The holes for the securing screws are drilled, the top hole is counterdrilled for the hex cap head. The lower hole is first drilled No. 32, and then drilled No. 7 to countersink the 6 BA hole, and to be tapped 0 BA for the column securing screw. Drill the cylinder block to match, not quite through, and tap the top hole 4 BA and the lower 6 BA. The two saddles can now be secured to the block with their screws, cut to fit, and using Loctite 275, in both cases.

Fit the columns and measure to ensure that parallelism is inherent.

The Crosshead

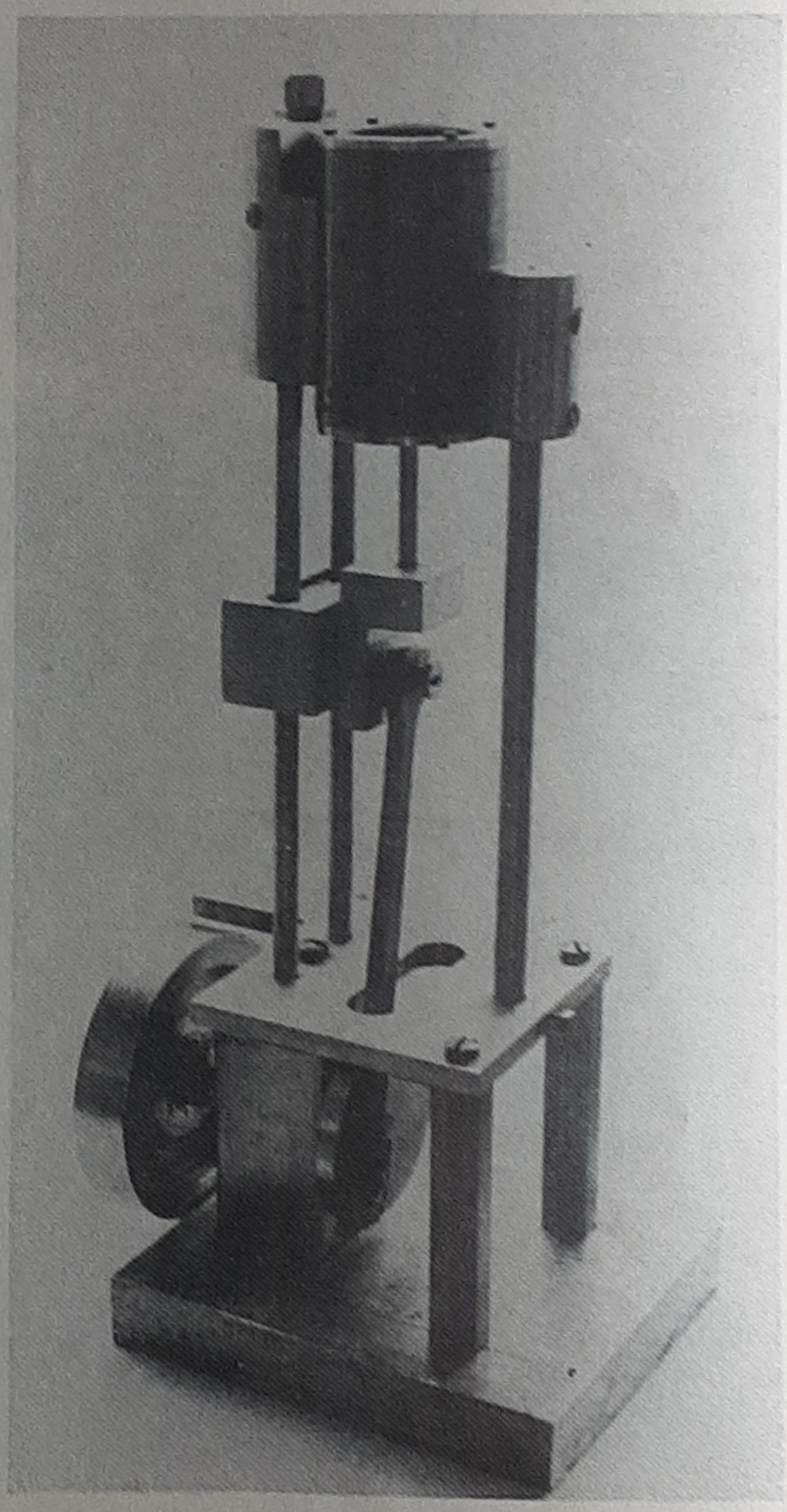
The crosshead consists of a block of aluminium alloy fitted with two turned cylinders of phosphor bronze to travel up and down the two $\frac{1}{4}$ in. diameter columns. The block is fitted with an L-shaped piece of alloy to accept the piston rod at the top of the gudgeon pin, of phosphor bronze, below. The gudgeon pin is screwed to the lower screw securing the L to the block. A well is milled in the top of the crosshead to oil the two columns and bearings.

The bearings are turned from $\frac{3}{8}$ in. diameter stock in the lathe and reamed. The holes in the block to fit are bored in the lathe at centre height to correspond with the holes in the saddle block. Mark with a scribe and an engineer's square two lines on the block the precise distance of the centres apart. Clamp the work on the cross-slide allowing for sufficient movement so that both holes may be drilled without unclamping. Find the lines with the tip of a centre drill before drilling through.

Fit the bearings onto the columns and slide up the block when all should fit together beautifully, and slide with a taste of oil. If they do not it is no good looking for the hammer. Check that the bearings are concentric; if they are the block will have to be remade, clamping down really tightly this time. I have mentioned before that better clamping bolts can be made from coach bolts with their heads filed to fit the T-slot. If all is well mill the slot for the well, drill and counterdrill the holes for the 4 BA hex cap head bolts; the bottom hole is counterdrilled deep so that the threaded shaft is available for the gudgeon pin. Secure the bearings into the block with Loctite 601.

Cut the L-shaped block and drill for the securing screws and tap. Secure the piece to the block and slide up to the piston rod to mark the position for the No. 22 hole, slide the motion down together to note that the position remains the same. If it doesn't you've done something wrong!

To be concluded



THE MARSHALL PORTABLE ENGINE

Part XIII

by Ron Kibbey

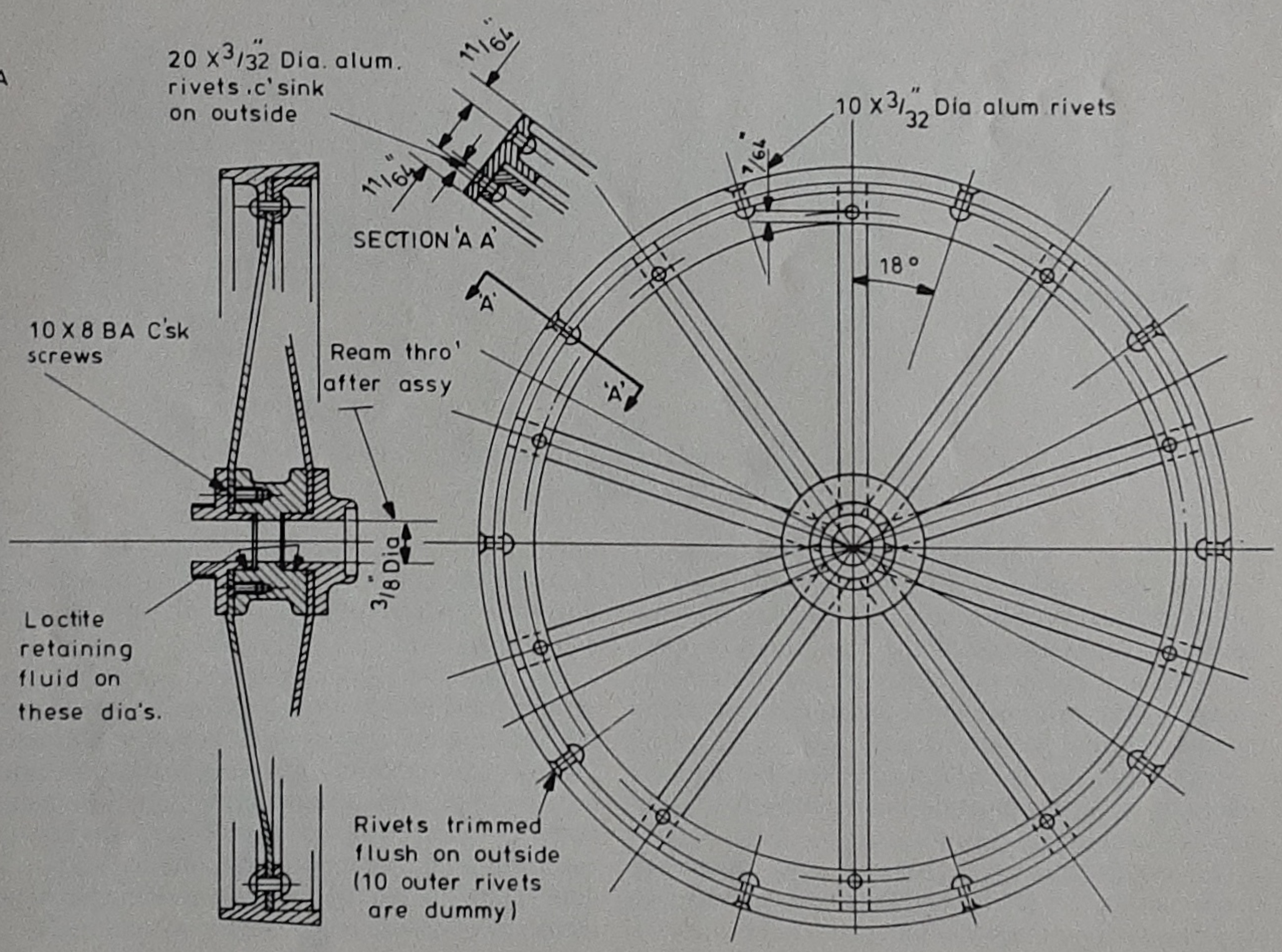
Continued from page 629

AS PROMISED in the previous instalment of the series, we are now moving on to the machining of the wheels. Light alloy castings for the rims and also for the inner angle ring are now available from Reeves. The construction is quite straightforward. The hubs are made up of three components which are machined all over from mild steel bar. The spokes are secured in radial slots in the hub centre piece by countersunk 8 BA steel screws before fitting the hub end pieces held in position by Loctite retaining fluid. The outer ends of the spokes locate in the wheel rim and are retained to complete the wheel assembly by one axial rivet per spoke through the angle section ring, the ring in turn being secured by radial rivets spaced midway between each spoke. The outer row of radial rivets through the rim are only, of course, for cosmetic reasons and are not functional.

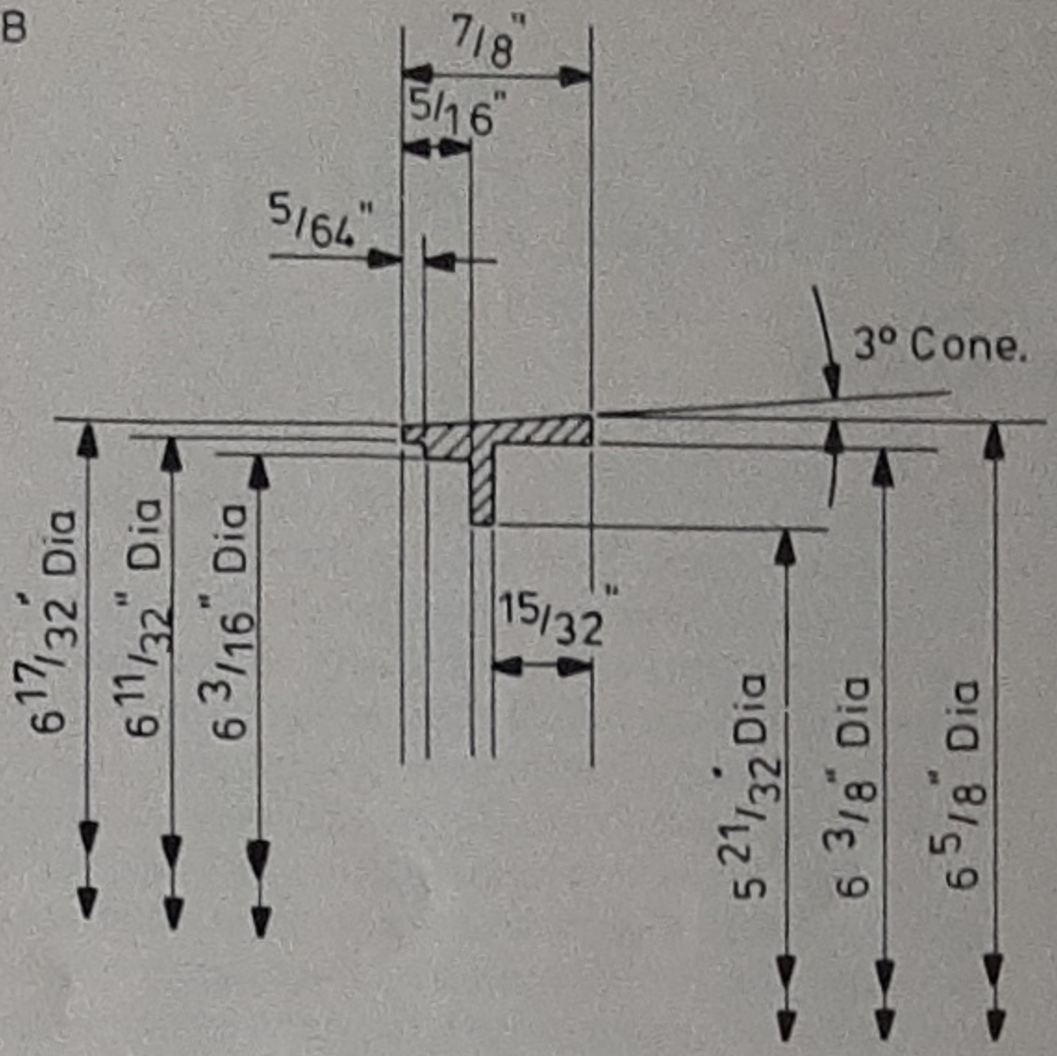
I suppose the first decision required is whether to start on a small front wheel rim or one of the larger hind wheel rims. I personally prefer to tackle the more difficult larger one first in the belief that, if the smaller job turns out to be easier than expected, I tend to get over-confident when tackling the larger one afterwards. The opposite philosophy may be to tackle the easier job first and get some experience of the problems before taking on the big one. The set up will be more or less the same in either case.

Mount the rim casting by chucking in the bore and, after adjusting to get the best concentricity, clean up the outside diameter parallel to a size in excess of the top of the taper diameter. Do not overtighten the chuck jaws since a light alloy ring of this section and diameter can easily be distorted. Make sure the turning and boring tools used are very sharp and that paraffin and suds brush are handy. Even with liberal application of paraffin, aluminium will tend to build up on the cutting edge

3A



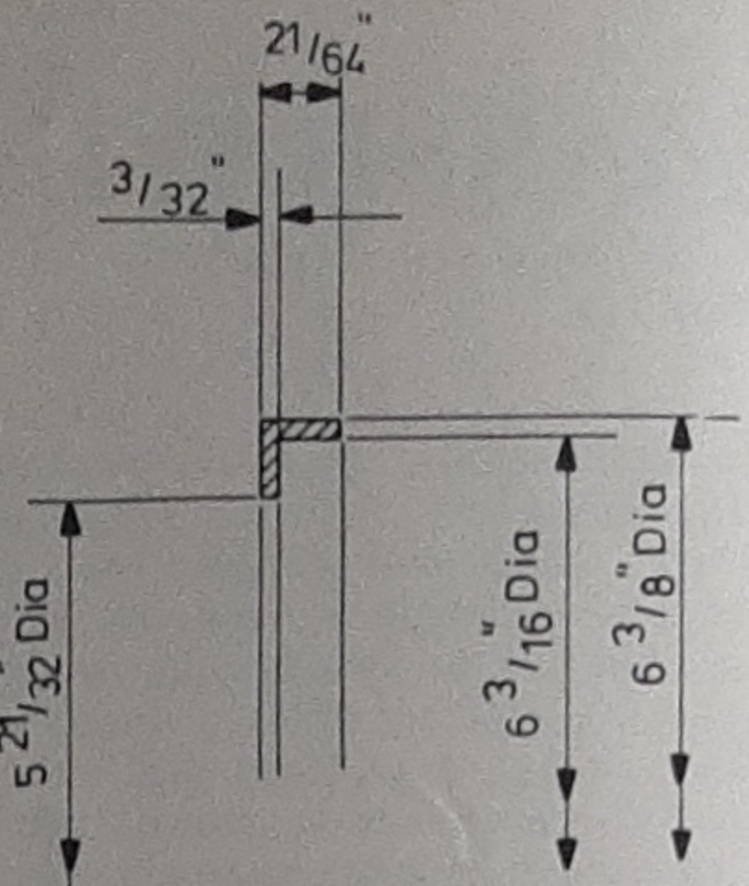
3B



RIM—HIND WHEELS - 2 OFF

MATL ALUMINIUM CASTING

(MACHINE ALL OVER)

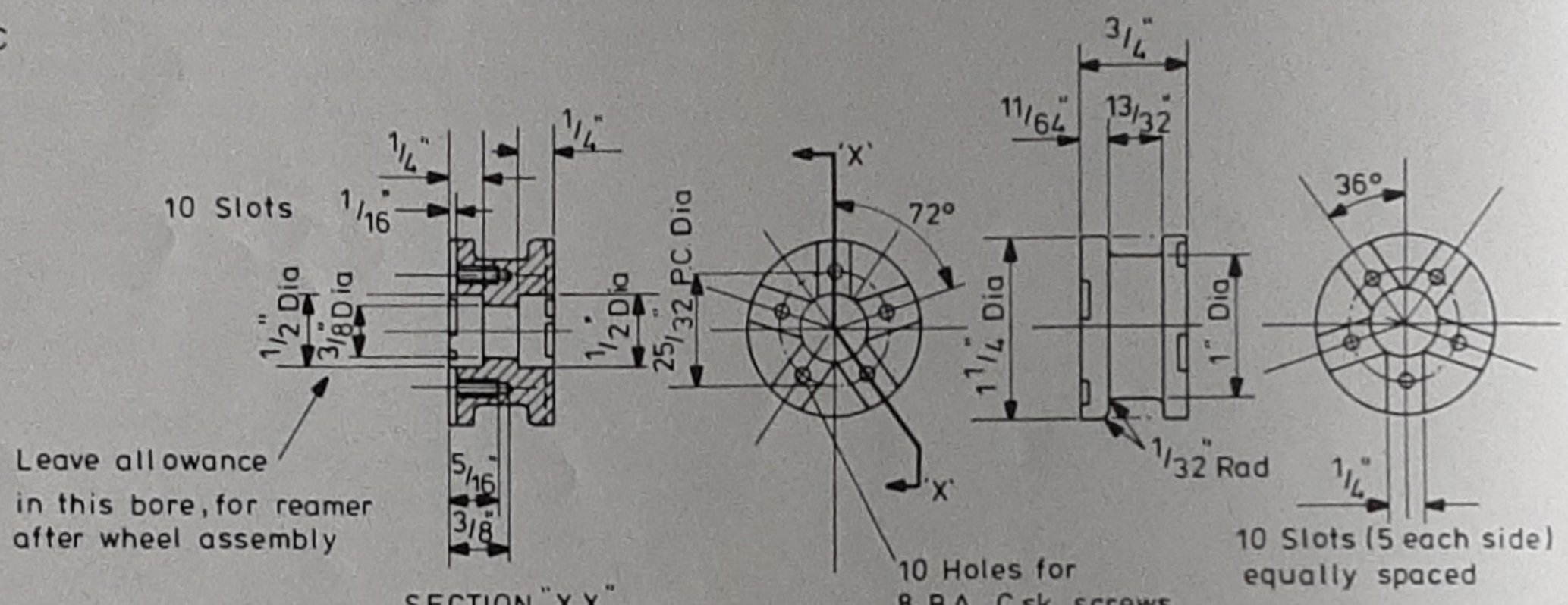


ANGLE PIECE 2 OFF

MATL ALUMINIUM CASTING

(MACHINE ALL OVER)

3C



HUB CENTRE - HIND WHEELS - 2 OFF

MATERIALS - M. S.

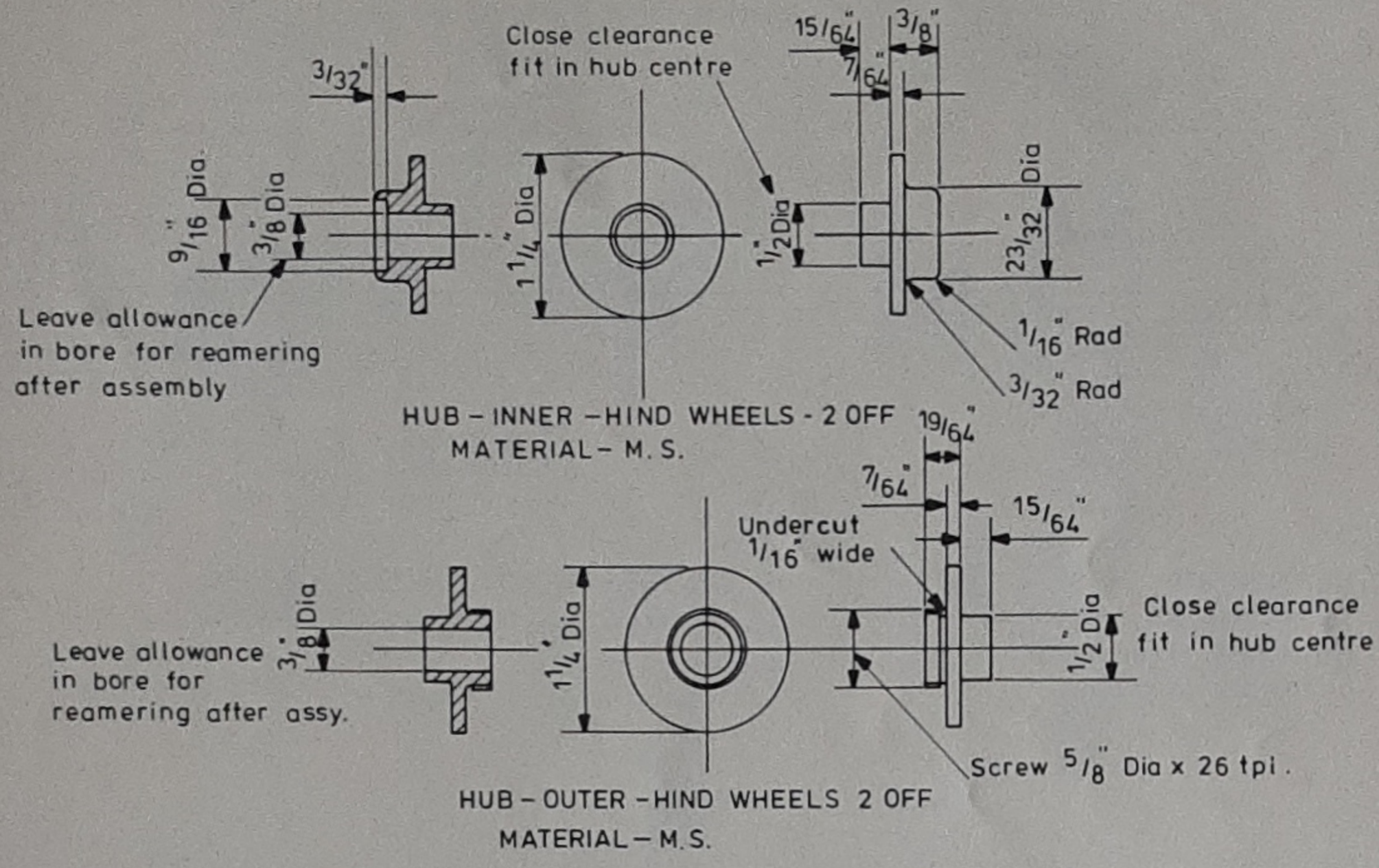
of the tool — this should be removed frequently. I suggest that slowest direct drive is used, say 150-200 r.p.m., and very fine cuts and feed rate. Having cleaned up the outside of the rim, chuck by this diameter and finish the bores to the dimensions quoted — this will, of course, require reversing in the chuck at the halfway stage.

Next chuck by the 6⅜ in. dia. (or 4½ in. dia.) bore and finish the outside diameter with the top slide set over at 3°.

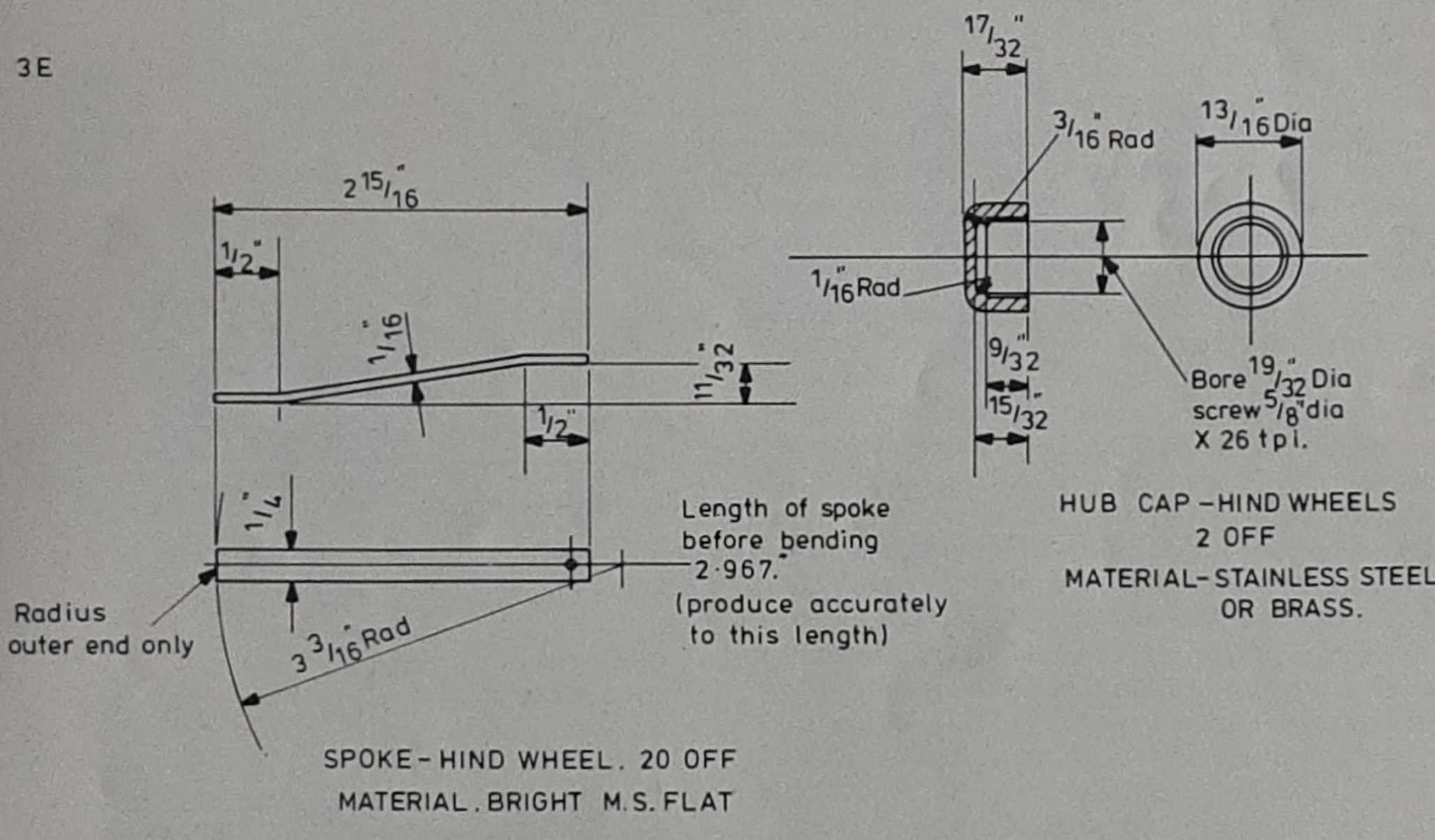
The angle section ring is, again, only a problem insofar as its flexibility makes chucking a tricky problem. Grip in the 4-jaw independent on the cast outside diameter, and finish machine the bore. Transfer the chucking to the bore and machine the outside diameter until the rim will push on with a snug fit.

The three hub components are straightforward turning jobs, except for the radial slots in the centre member for the spokes. For builders without the facility of some form of dividing head, the accurate spacing of the slots, particularly the ten slots in the larger wheels, will be a problem. Rather than resorting to marking out and filing the slots, a few hours spent in making a simple dividing head using a change wheel of, say, 60 teeth, so that the hub can

3D



3E

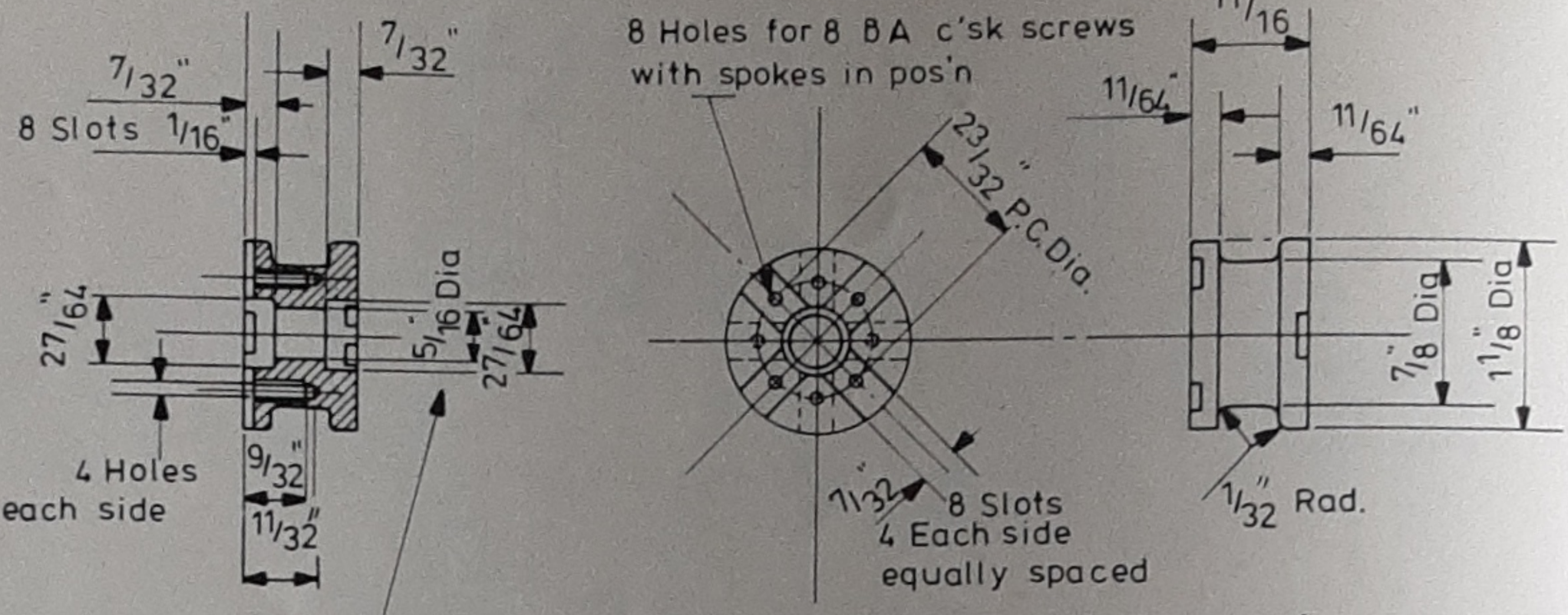


be rotated on a mandrel mounted off the boring table or vertical slide, would be well worthwhile. With this facility, and with a ¼ in. dia. and 7/32 in. dia. end mill in collet or 3-jaw chuck, the slots offer no problem.

The spokes should be accurately finished to the lengths quoted before bending, and the outer end radiused as shown. I took some care when making my wheels to make sure the spokes were accurately cut to length and bent to give a consistent offset, this was in the hope that, when assembled, the wheels would not require a lot of setting to run reasonably true. To my surprise, in all four cases, the wheels, as assembled, ran near enough to true to not need any setting at all.

When assembling the spokes in the centre hub

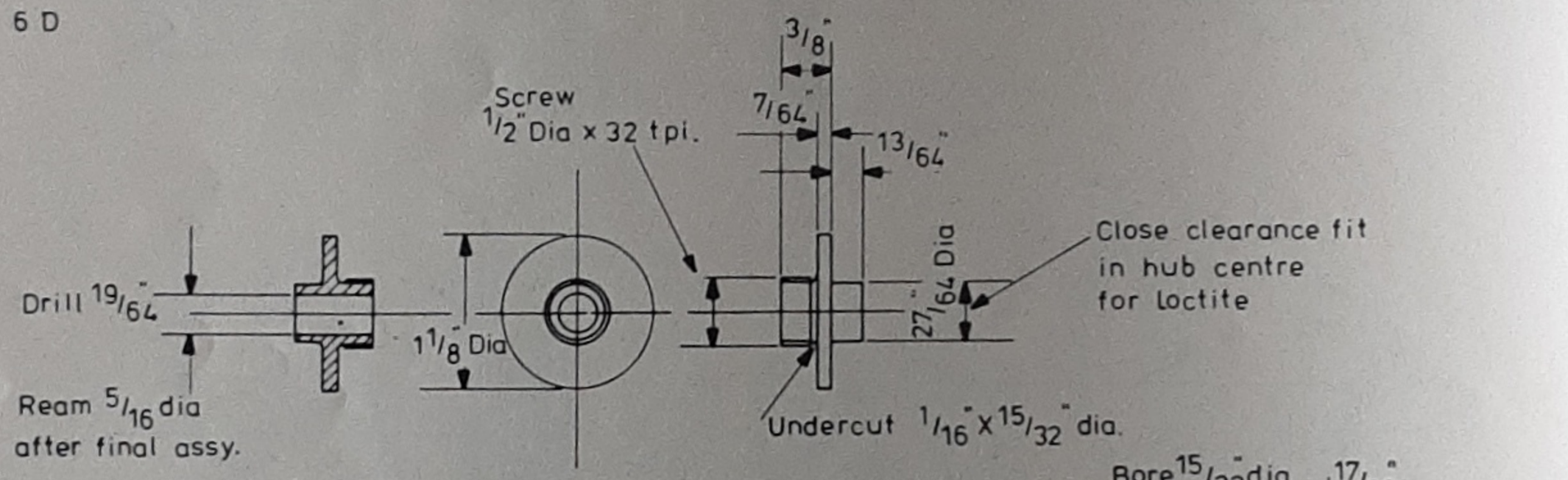
6C



HUB CENTRE-FRONT WHEELS - 2 OFF

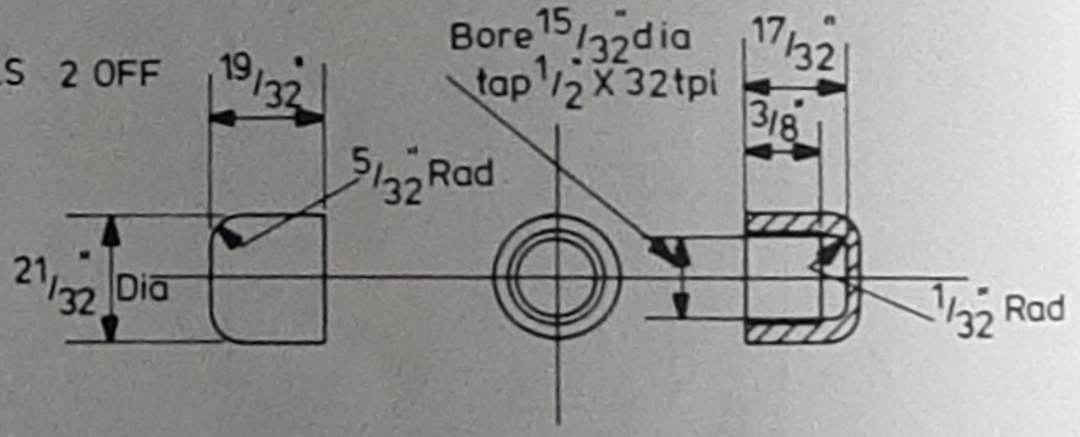
MAT^{L} – M.S.

6D



HUB - OUTER - FRONT WHEELS 2 OFF

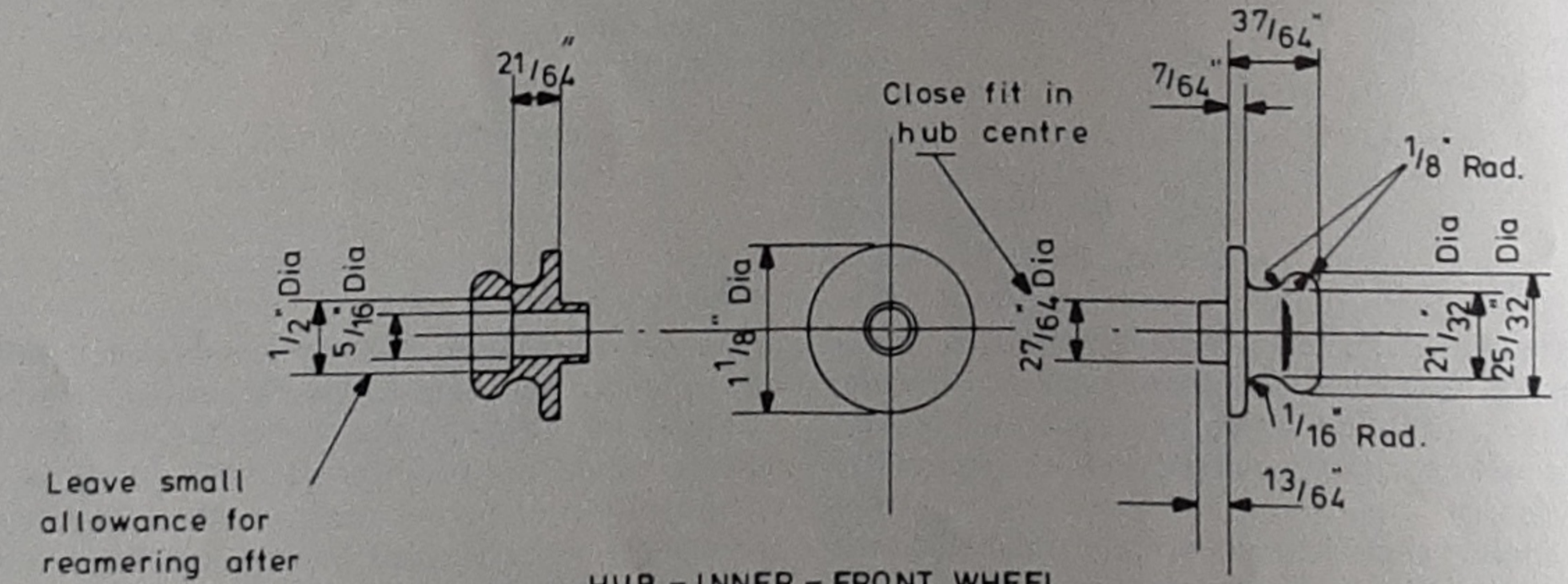
MAT^{L} M.S.



HUB CAP - FRONT. 2 OFF

MAT^{L} STAINLESS STEEL

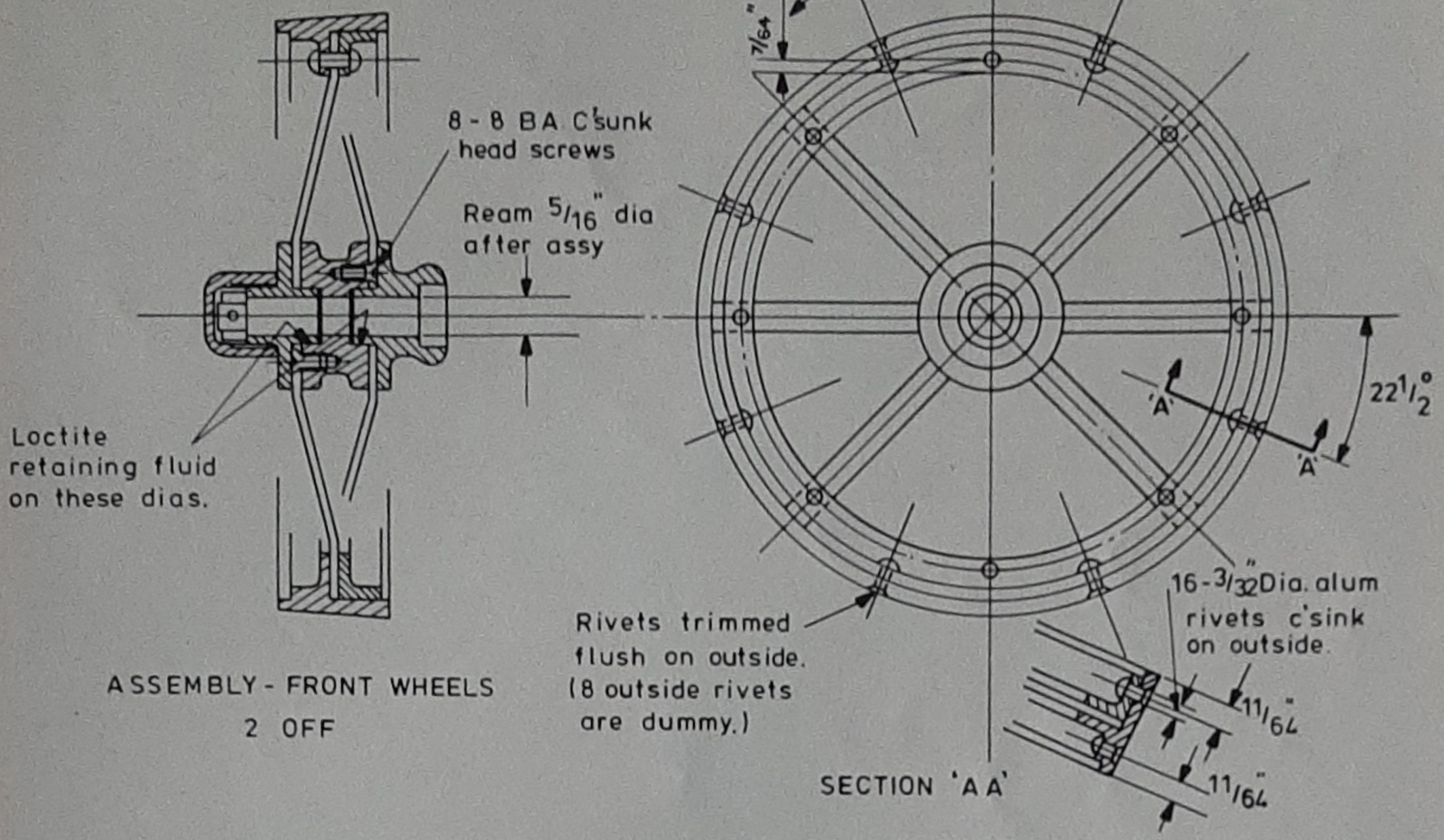
6E



HUB – INNER – FRONT WHEEL.

MAT^{L} M.S. 2 OFF

6 A


8 X 3/32" Dia. alum rivets
7/64"
8 - 8 BA C'sunk head screws
Ream 5/16" dia after assy
Loctite retaining fluid on these dias.
22 1/2°
'A'
'A'
16 - 3/32" Dia. alum rivets c'sink on outside.
Rivets trimmed flush on outside. (8 outside rivets are dummy.)
11/64"
11/64"
SECTION 'A A'

ASSEMBLY - FRONT WHEELS
2 OFF

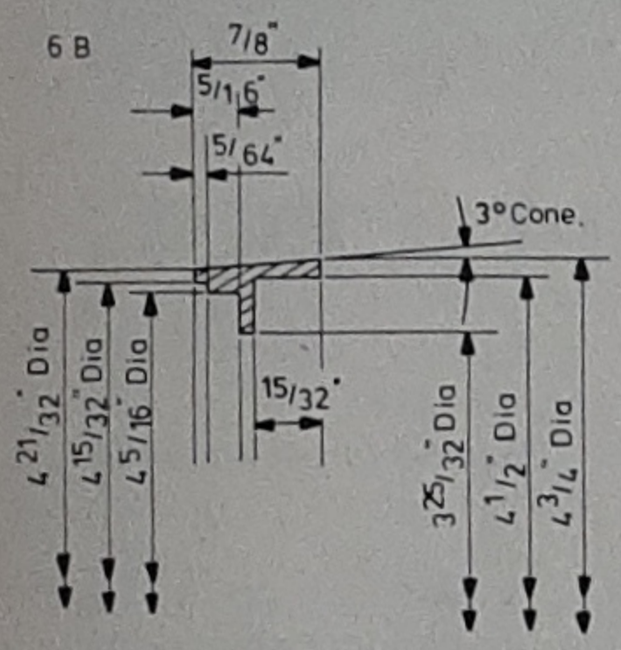
slots, in order to drill and tap for the 8 BA countersunk screws, it will help position these correctly if small stubs are fitted in the counterbores in the hub (27/64 in. and ½ in. dias. respectively) and holding the inner spoke end in contact with the stub whilst drilling through both components. Minor differences in the bending set of the spokes in any wheel will cancel out on final assembly, the secret is to get the spokes to the correct length before bending.

Having assembled the spokes and hub centre and secured these with 8 BA countersunk screws, and having first made sure that the screw heads are below flush, degrease and clean the assembly and also the hub inner and outer members. Apply Loctite retaining fluid to the spigot recesses and spigots, fit the inner and outer hub members and lightly clamp in the vice for half an hour or so. After giving several hours to be sure the bond has become permanent, the hub and spoke assembly can be offered to the outer rim, and held in position by the angle ring. The holes for the axial rivets, one through the end of each spoke, can now be drilled and aluminium snap head rivets fitted. Reeves's stock range includes suitable aluminium rivets.

Next, the radial rivets, two in line between each pair of spokes, are fitted. The outer row is, of course, to give the illusion that an angle ring is fitted on either side of the spokes.

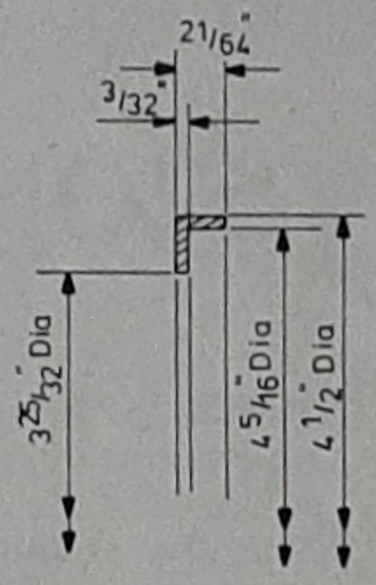
Finally, put a reamer through the wheel hub bores. The finished wheel can now be spun on the axle stub to test for truth. Providing the swash at the rim is no more than, say, 1/32 in, they can be regarded as satisfactory. *To be continued*

6 B



RIM - FRONT WHEELS 2 OFF

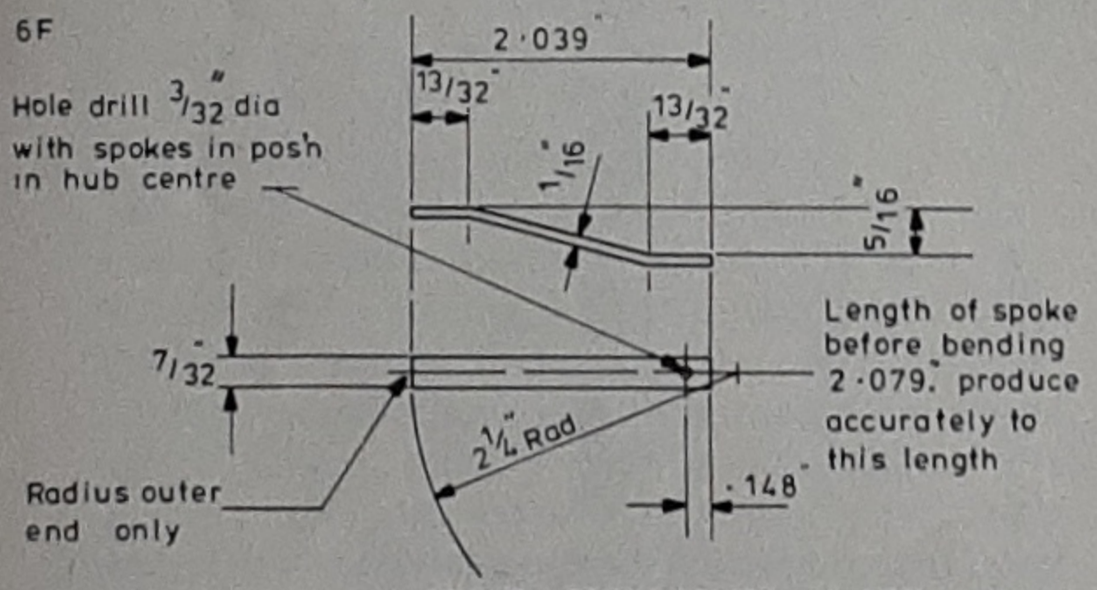
MAT L ALUMINIUM CASTING
MACHINE ALL OVER



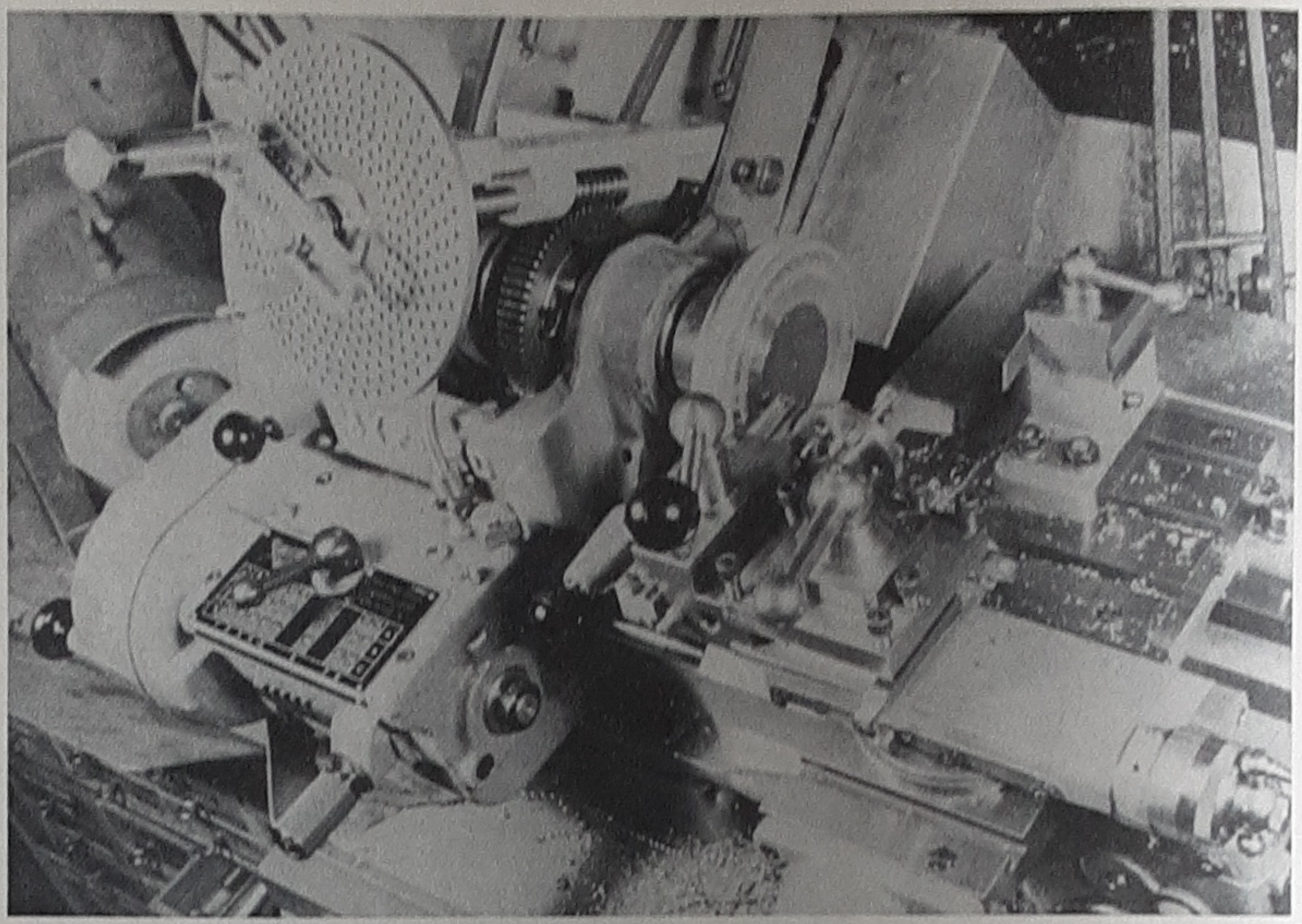
ANGLE PIECE 2 OFF

MAT L ALUMINIUM CASTING
MACHINE ALL OVER

6F



SPOKE - FRONT WHEEL 16 OFF
MAT L BRIGHT M.S. FLAT (1/16" X 1/4").



DIVIDING AND DIVISION PLATES

Part III

By Geo. H. Thomas

Continued from page 688

DO NOT BE TEMPTED to scribe all the circles before tackling the dividing. I think that it would be better to complete each circle as it is laid down because one is then always working on the innermost circle and a lot of possible confusion will be avoided. For setting the dividers, a table giving all the necessary information as far as is possible has been worked out and it has been included here. The following notes will explain the manner of use.

"A" is the number of the circle on the template counting from the outside.

"B" gives the number of divisions on the template. These have been arranged in descending order and they do not necessarily correspond with the final plates, either in position or the number of divisions.

"C" is the length of chord based on a circle diameter of one.

"D" is the diameter of the circle as struck on the template and measured.

"E" is the product of C x D which gives the correct dimension to which the dividers should be set.

A	B	C	D	E
1	91	.0345		
2	77	.0408		
3	49	.0641		
4	47	.0668		
5	43	.0730		
6	41	.0766		
7	37	.0848		
8	31	.1012		
9	29	.1081		
10	23	.1362		
11	19	.1646		
12	17	.1838		
13	10	.3090		
14	8	.3827		
15	6	.5000		

Note: In the above list there are only 15 circles instead of 16, this is because the 49 circle is used twice. The last circle, 6, is already divided by the 60° lines. The tables

included with this article are only for plates I and II which cover all ordinary requirements. I would be pleased to supply all necessary information for plates III and IV if requested but I imagine that sufficient information has been provided to enable readers to work things out for themselves if I say that my formula for calculating the chordal distance for diameter equals 1 is: C = Sin (180/n)°, where n equals the number of divisions.

First make a copy of the table, leaving room for the figures in cols. D and E. Measure the diameter of the (first) circle using your new decimal rule tilted up so that you look down along the graduations. Enter the dimension in column D and multiply it by the figure in column C. This goes into col. E and is the correct setting for the dividers.

Still using your best decimal rule and an eyeglass, set the dividers to this dimension as accurately as you can. Don't rest the points of your dividers on the hard rule, lay them down, points away from you and with the other end lifted to an angle of about 20° above the horizontal — the amount of lift will depend on the shape of the points. With the left-hand point lying in the left-hand end of the 1/100ths grads, adjust the dividers until the right-hand point indicates the correct dimension. With (or without) a little practice, it is possible for *anyone* to work within two thou by this method. (See fig. 1, 8). As an example of this method of working I laid out the 49 divisions on the fourth circle of fig. 1, 1. The circle measures 5.270 in. and the chord, from the table, equals .0641 in. which, multiplied by the diameter, gives a divider setting of .3376 inch. One can read .33 in. with confidence and estimate the .008 in. as 4/5 of one of the hundredth grads as shown on the diagram. With the dividers (draughtsman's) so set I stepped round one half of the circle. At the first 60° line all appeared to be going well, the eighth step was short of the line by about 1/6 of a step as nearly as one could estimate. Carrying on to the half-way line, which should have fallen exactly in the middle of a step, I ended up about 1/64 in. to the right so that my setting gave an error of 15 thou over 24 steps! Even allowing for the element of "joss" in that result, it does indicate that one can work quite accurately with quite simple tools if they are in good condition and you know how to use them.

But we have got ahead of ourselves and must go back to the stepping out of the outer circle. Having made a fine prick-point with a scriber at the intersection of the starting line with the first circle and having also set the dividers to the correct figure for 91 steps, we set out from the marked point stepping carefully, just resting each point in turn in the scribed circle and without marking the plate at this stage. If you have been very careful (or lucky) you will take 15 steps and fall short of the first 60° line by about 1/6 of a step (1/6 of 91 is 15 1/6). If the error in the divider setting was two thou, the fifteenth step would fall 1/32 in. out of place and this would readily be seen (see fig. 1, 9). If the error is judged to be less than 20 to 30 thou it might be best not to attempt to alter the dividers. Mark on the circle, with a push from a scriber, the correct spot where the last step *should* have fallen and then using this as the starting point, step out the next 60° sector which should end up ⅓ of a step short. Once again, make a correct dot as the next starting point. The next, the half-way line should fall in the middle of a step but the same error should be apparent. It will be observed that by working in this manner any errors in the steps are not allowed to accumulate, so creating a large and unacceptable error at the end, but the total error is split into six equal parts distributed equally around the circle.

When carrying out the initial stepping round a circle don't push down too hard on the dividers or you will make a little "pit" and if, subsequently, you make a small adjustment to the dividers, and any adjustments are likely to be very small, the points will tend to drop into these pits and so defeat the object of the adjustment. One must acquire a delicate touch for this operation — practise on some fine straight lines scribed on scraps of sheet metal if you are not sure of yourself. Learn to transfer pressure from one leg to the other without lifting either from the plate.

Having satisfied ourselves about the setting of the dividers, we can now start again from the beginning but this time we scribe a very short arc up to the circle and then allow the point of the dividers to drop into it — it should drop in with a small "click". Now transfer the pressure to that leg and swing the other one round and repeat the process. By using this method, tiny dots will be formed on the circle and there will be a small indicating "tick" at the side. Don't forget to start off from the corrected point at each sector. The best thing to do next is to go right round the circle with the centre-punch which, if it is lightly dragged around with the point in the circle, will search out the correct points. Make sure that the enlarged dots do not stray away from the circle — tiny errors of position around the circle will not matter because they will be divided by 3600 eventually, but errors in a sideways direction will take the punch dots out of the path of the plunger.

Now scribe the next smaller circle, mark the dot at the intersection with the vertical zero line and carry on as before. Take heart; after the first two circles the work becomes rapidly easier as the numbers become less.

Drilling the plates. After completion of the templates comes the drilling of the final plates and, as I have intimated, the details of this will depend upon the nature of the worker's equipment and ingenuity

but I will jot down a few random thoughts. First, the mounting of the plates. They are too large for the usual 4 in. s.c. chuck but could be held in a 6 in. 4-jaw and set to run true in the bore. They could be held on a faceplate with three or four small clips not standing out too far from the front of the plate or they will interfere with the drill bush. As the holes need not be drilled deeper than about 3/32 in. at this stage there will be no need for wood backing. Alternatively, a stub mandrel, fitted with nut and washer, could be turned up in the chuck and this would hold all plates dead true from the bore, which is important.

Drills

The ideal set-up is to use jobber's drills running through a fixed hardened bush with not more than about ¼ in. standing out. The correct installation of a suitable bush is a somewhat tricky business — it has to be carried by the cross slide, be dead in line with the drill and move with it. One possible, and fairly simple, arrangement would be to erect a vertical plate of stout sheet metal in front of the drill and anchored to the boring table. This would have a clearance hole, say ⅜ in. or ½ in. dia., through which the drill passes. The actual drill bush could be a piece of mild steel about ¼ in. to 5/16 in. thick having a cluster of drill-size holes near the centre, and attached to the vertical plate by a pair of screws passing through clearance holes in it (fig. 1, 10). Using this arrangement it would be a simple matter to align the jig on the drill before tightening the holding screws. The plate would, of course, be case-hardened. The cluster of holes will be useful when one of them has worn oversize, as it will. (There are 732 holes in the two plates and over 1500 in a set of four). If a bush is not provided, and it is strongly recommended that it is, then do not use jobber's drills, they are too long and whippy for this job. Use stub-length drills which are readily available and are much less likely to wander. (Buy half-a-dozen while you are about it). If these drills can be sharpened by the 4-facet technique, so much the better because they "wander" hardly at all. Users of the "Quorn" grinder can do this, see the "Quorn Tool and Cutter Grinder" by Prof. D. H. Chaddock, Vol. 140, p. 738.

I have already suggested that the holes be drilled only about 3/32 in. deep at this stage and that the drilling be completed subsequently in the drilling machine which will not only be quicker and easier but it will save wear and tear on the bush. It presents also certain advantages when we come to countersink the holes on the front face as we should. If the holes are drilled right through in the first instance and we then set the drilling machine to give a uniform countersink to all of them there is a fair chance that burrs will be thrown *into* the holes which would need to be removed by passing a drill through them. In view of this it would seem to be best to drill shallow, countersink and then complete the drilling, thus removing any burrs without an extra operation. I might be inclined to drill the initial starting holes with a slightly smaller drill — say, 2.6 mm or 37 or 38 — and use the 2.8 mm. drill when drilling right through. The countersinks can be about .015 in. to .020 in. wide. I use home-made countersinks of "D-bit" form which should have the flat taken a little below the half-way line and not, as for a proper "D-bit" above the half-way line. These *never* chatter but they will tend to throw in a burr if they are not kept sharp. Stone the flat face. Countersinks made like the centring tool at fig. 1, 6 are also very good but a trifle more "hungry" than the "D-bit" form.

Of course, none of this drilling can take place without first having installed a drilling spindle on the boring table — or some part of the slide-rest — and fitted the newly made dividing head to the headstock. The template will be fitted to the dividing head, taking the place of a proper division plate, and if it is made of 16 s.w.g. sheet metal it would be advisable to put a packing washer 3/16 in. thick under it. You should have finished with the ring jig at this stage so you can thin it down to 3/16 in. and open the holes to 4 BA clear. Countersink the screw holes in the template to take the 4 BA heads. Assuming that all this has been prepared, it is now necessary to consider the indexing procedure and this is best shown on another chart on which the first group of eight is for plate I and the second for plate II. The figures in the columns represent, in order:

1. The number of the ring on the plate from the outside.
2. The number of holes in that ring.
3. The number of the ring (from the outside) on the template to be used.
4. The number of whole turns of the worm.
5. The number of spaces to which the sector arms should be set*.
6. The holes (centre-punch dots) in the circle.

*Remember that we are dealing with spaces rather than holes. To provide a movement of seven spaces we need the arms to disclose eight holes or punch marks.

1	2	3	4	5	6
1	91	1	0	60	91
2	77	2	0	60	77
3	50	13	1	2	10
4	49	3	1	11	49
5	45	15	1	2	6
6	38	11	1	11	19
7	34	12	1	13	17
8	32	14	1	7	8
1	47	4	1	13	47
2	46	10	1	7	23
3	43	5	1	17	43
4	42	3	1	21	49

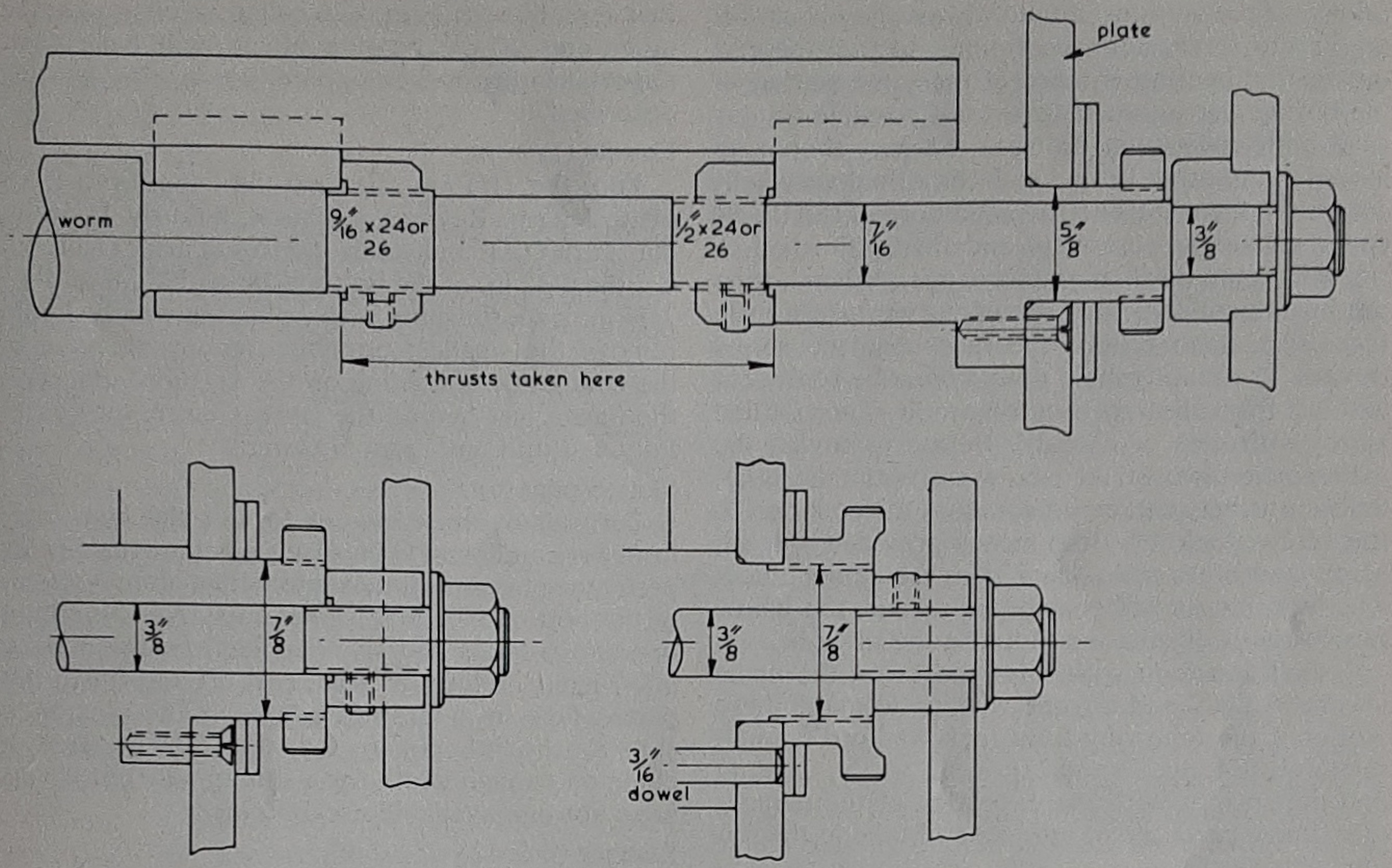


Fig. 3: Some alternative constructions for Radford Dividing Attachment.

5	41	6	1	19	41
6	37	7	1	23	37
7	31	8	1	29	31
8	29	9	2	2	29

As an example of the use of the above, let us consider the 4th circle in the second plate; this has 42 holes. To obtain this we use the 3rd row on the template, giving one whole turn and 21 spaces on the circle which has 49 dots.

When J. A. Radford made his dividing head he utilised a number of components such as indexing arm and plunger, sectors etc. from the Myford dividing attachment and these were detailed in his construction drawings. I preferred to design my own details and I am including a sheet of drawings (fig. 2) showing the alternatives. The handle is certainly more convenient and comfortable to use and the sectors are very much simpler and cheaper to produce and to my mind look better.

Quite apart from the construction of the handle and sectors which are, after all, only details, there is one feature of Radford's design which disturbs me and others. This is that whenever it is necessary to change a division plate, the end-adjustment of the worm is lost and one has to re-adjust it correctly again, making sure that there is no end-play. This is a nuisance and is fundamentally unsound. Mine is the same but I would not make another one like it. Fig. 3 shows some alternative ways in which this can be overcome without too much design revision. One of the schemes dispenses with the plate fixing screws so that, after removing the indexing arm, it is necessary only to undo a large knurled nut which releases the sector arms and the plate which is located on the central spigot and by a well-fitting dowel. The plates for these constructions have a bore of .875 in. so that Myford plates, which have a bore of .625 in., could not be used without opening up — but this article is all about making your own. The item which is called the "index plate support block" (B on Radford's G.A. drawing) would have to be modified to suit the alternative arrangements; I would make it from a piece of FCMS. And while talking about this part it would be as well to draw attention to the importance of the squareness of the two ends in relation to the bore and also the squareness of the faces of the two collars which run in contact with them. This requirement applies in all cases where a screw is used to impart accurately controlled or measured motion to another part e.g. the leadscrew or feedscrew of a lathe or milling machine. If the abutment faces of the bearing and the thrust collars are not absolutely square to the axis of the screw, then "camming" will take place and the screw or worm will be pumped to and fro with each revolution, thus nullifying a lot of otherwise careful work.

To make sure that these troubles do not arise, the

following precautions should always be observed: (a) Try to arrange the operations so that the end face of the bearing is faced at the same setting as the boring operation. If this is not possible (in our case both ends must be true) the part should be mounted on a true turned stub for a final very light cut on the face. (b) The threaded bore of the thrust collar should be screw-cut and finally finished to size with a tap (G.T. if you have one). When boring the nut or collar before screw-cutting turn a little recess so as to relieve the face near the screw thread. The mating male thread *must* be screw-cut and left from the screw-cutting tool — not fiddled about with dies or chasers. Before removing the male portion (worm, feedscrew etc.) from the lathe, unless it is between centres, mount the collar on to the screw, lock it by the means provided — grub screw and brass pad — and skim the contact face. The little recess will enable you to skim the whole face without digging the tool into the thread.

I shall conclude with a few notes on the items shown in fig. 2 and anyone wishing to make these will omit the following from Jack Radford's drawing (Vol. 134, pp. 26 and 27): K, L, M, N, O, P, Q and the spring. With the exception of the plunger (9) all new parts are of mild steel. Make in the following order:

Arm (5)

Mill to ⅜ in. x ¼ in. from 1 in. x ¼ in. Mark two end centres carefully; drill and ream both at, say, ¼ in. diameter. Round the two ends on rotary table with ¼ in. centre pin; mill slot with 7/16 in. slot-drill or end-mill, the width shown as 15/32 in. allows for cleaning up cuts on both sides of the slot which must be parallel throughout its length. Set up on faceplate and open up one end hole to .585 in. dia., screw-cut 26 t.p.i. and finish the thread with a tap if available. (Note: The dia. .585 in. allows for a depth of thread of .020 in. using a tool with the correct radius or flat on the end. The full depth without truncation is .0246 in.).

Collar (1)

Face end of ⅜ in. bar, centre and drill undersize. Transfer to milling machine, or equivalent method, and mill the two flats parallel and to a very good fit in the arm. Part off. Back in the lathe; face back, finish hole to size (.335 in.) — an 8.5 mm. drill might do — screw-cut 26 t.p.i. and finish with tap. Don't forget the recess round the thread on this side. Drill and tap for screw; fit a brass or copper plug about 1/16 in. thick and a good push fit in the tapped hole, run the tap back into the bore — well in — back up the plug with the grub screw and, with a little judicious tightening of the screw and twisting the tap back and forth, the plug will have some thread form cut across its end. I always treat brass plugs in this manner — it pays because hard brass is not much softer than mild steel. The thrust face on this item, like the ½ in. x 26 collar which goes at the other end of the bearing block, will have their important thrust faces trued up *in situ* as just described.

Handle (7)

Turn the 11/16 in. dia. and the bevel first. Part-off to length. Reverse in chuck, hold by 11/16 in. dia. Turn O.D. and screw-cut to suit arm. Drill, but *not* the 5/32 in. at the bottom, bore .398 in. and s-c 7/16 in. x 26, finishing with a plug tap which should remove the smallest possible amount. Reverse in the chuck again, holding on the 11/16 in. dia. with the flange just behind the jaws. Centre very carefully and drill and ream 5/32 in.

Slotted plug (6)

Turn all over; screw-cut to suit the last item; drill, *bore* and ream ¼ in. (use a machine reamer for preference because it reams to within about 1/16 in. of the bottom of a hole), next carry out all milling operations (slots and spanner flats) *before* parting off. Finally, return to lathe, part off and finish the parted face in a screwed adaptor. The clearance slots for the little pin are shown as 5/64 in. wide, a common enough width for a slitting saw but if you have not one available use 3/32 inch.

Plunger (9 & 12)

Silver steel. It is most important that all diameters are true to the axis otherwise we shall get sticking in some positions or the inevitable cure — sloppy fits. The classical way to handle jobs of this sort is between centres which ensures concentricities throughout but for anyone with a Griptru chuck who knows how to handle it I would suggest do it your own way. For those who would like a little guidance, I suggest the following:

1. Drill small centre as shown on drawing at R/H end.
2. Reverse in the chuck; rough out .250 in. dia. leaving about .005 in. o/s. Turn end of plunger to suit holes in plates, leave over-length and turn a 60° cone as shown at item 12.
3. Reverse in chuck again, gripping on .255 in. dia. and rough down the 5/32 in. stem with support from the tailstock in centre.
4. Finally set up between centres, male and female, and remove the last few thou where it has been left over-size. For this operation it is desirable to have some centres — especially the females ones — smaller than the standard article and I have made adaptors to fit the head- and tail-stock that carry any of my watchmaker's centres and chucks and these are invaluable at times.
5. Harden and temper the extreme end; don't overheat because we must avoid distortion at all costs.
6. Drill and fit the 1/16 in. pin which should be trimmed down to stand out a full 1/16 in. The

making of this plunger and the items 6 and 7 so that the plunger moves freely but without any perceptible shake is a good test of one's ability at concentric turning.

Sector arms (14)

Select a piece of 16 s.w.g. bright sheet steel free from surface imperfections and clean up one side to a nice straight grain with fine emery cloth or paper wrapped round a cork or wooden block. This is the only stage at which to do this job — later on you will round the edges and the whole job will look shoddy. Mark out two arms, one in reverse. Only one of them has the 3/16 in. hole at .900 in. radius. Drill the ⅛ in. holes for the handles and a small hole, ⅛ in. will do, at the centre of the .625 in. bore. Cut out roughly to profile — a bandsaw is quickest and best — leaving a trifle for cleaning up. Fix the two parts together with a 5 BA screw and nut in the end holes, clamp the assembly down on to a piece of plywood on the faceplate with the two centre ⅛ in. holes running true — a ⅛ in. peg will bring them coincident — and then open up and bore out to a free fit on the plate spigot (you will not yet have carved up the plug gauge).

Mount them over a ⅝ in. spigot on the rotary table with the one as drawn uppermost and the other turned over to coincide. Mill round the boss and finish the rest of the outline by filing. If you would like to have a professional finish to the edges — dead square and the grain running round the outline — try the following: Wrap a piece of paper around half the length of a ⅜ in. or ½ in. dia. round "India" oilstone stick of medium, or preferably, fine grade. Grip it firmly but gently in the chuck of a drilling machine and bring up the table until the lower end of the stick has passed down into the hole in the centre. Run the machine fairly fast and, with paraffin as a lubricant, run the outline of the sector arm along the stone, turning the arm as necessary to maintain continuity of movement. Alter the height of the table a little from time to time on a long job to avoid grooving the stone. If you have never tried this before you will be quite surprised at the excellence of the finish obtained and some loco builders might, with advantage, try it on their coupling and connecting rods.

One of the arms is cranked to bring the faces flush on the plate, the other one is fitted with a steel bush (15) riveted in. The back should be countersunk a little and the bush opened up by means of a centre-punch with a 90° end. Tap 4 BA and file flush on the back. The little knobs (13) are riveted into the ⅛ in. end holes and the two arms are clamped firmly together by means of the special washer (16) and screw which is best made with a head about 5/16 in. diameter.

The wormshaft, which was item D in the original article, has not been redrawn but the threads have been altered from BSF to 26 t.p.i., ½ in. BSF being rather too coarse for an adjusting nut. Also, the worm details must be corrected to 20° pressure angle as I have pointed out on more than one occasion. Don't cut the two 26 t.p.i. threads until the two mating parts have been made. Some workers have a rooted objection to threads like 26 t.p.i. because "you can't drop the nut anywhere" but, with a TDI having 16 teeth on the wheel, the nut can be dropped at any quarter of a revolution of the counter wheel, i.e. at *any* numbered position. I imagine that the objection might possibly arise from the fact that the screwcutting operation is being carried out at too low a speed — possibly bottom back-gear. For any of the 26 t.p.i. threads in this equipment, I would use top back-gear (in the low range of the Super-7) i.e. 80 r.p.m. and at this speed, and set for 26 t.p.i., a numbered position would pass every 10 seconds so that the average "waiting time" will be 5 seconds. This, surely, is no hardship — hardly time to take a pull at the pipe!

The plunger spring (11) is made from 23 s.w.g. (.022 in.) spring steel wire; 16 coils and a free length of 1⅜ in. or 1½ in. It must pass freely over the 5/32 in. stem and be free also in the bore of the tube (8) which acts as a limit stop for the outward movement of the plunger. Note that the ends of all four slots in item 6 are opened out to give free access for the 1/16 in. pin.

No mention has so far been made of the spring which bears on the sector arms. In the Myford attachment it is a commercial double-coil spring made from flat material about ⅛ in. wide. If you can find one like it, well and good, but if not, you might wind one up — 2 or 3 coils — from 16 or 14 s.w.g. wire not forgetting to grind the ends off. An alternative would be a couple of curved washers assembled back to back with, perhaps, an adjustment in the thickness of the washer (2).

Much of what I have written is a counsel of perfection and I hope that readers will not be put off making their own plates in the belief that it is all very difficult — it isn't! At the Exhibition last January I was discussing the methods outlined in this article with someone very well-known to readers of *M.E.* and he remarked "Why go to all that bother? The job can be done with a school protractor and a pencil" or words to that effect. In a joking manner he was correct because of the inbuilt correcting process which takes place in the dividing head, though I would probably run into more troubles with his school protractor than by using my own methods which can, after all, be used on those occasions when marking out on circles *has* to be done accurately. No harm is done by learning to use tools properly. As I have already indicated, if we had a cumulative error of 1/16 in. (which we have avoided by dividing the circle into six equal

parts) this would be reduced to one thou on the plate and 17 millionths of an inch on the work produced from that plate, and no one is likely to have worms or worm-wheels anywhere near that kind of accuracy.

It was intended to mention briefly an alternative method of working by which the hole positions are determined by angular measurement (my friend's "school protractor") instead of by stepping out chordal distances but further thoughts on the subject have revealed so many advantages in working to angular spacings that a second part of this article will follow as soon as possible. I have under consideration three or four different ways of working, all of which appear to be simpler than those already covered — it is, to some extent, a matter of available equipment — but before completing the writing I wish to test the methods by making some 4 in. plates for the small dividing head which I have already mentioned. Suffice it for the moment that the tables of my staking tool and the small drilling machine, which are interchangeable, have been graduated in degrees and provided with vernier scales reading to a tenth of a degree (actually, half a tenth) and I have not overlooked those many readers with vertical millers and, hopefully, accurate rotary tables.

To conclude and *pour encourager les autres*, I received a letter last year headed "S.O.S." from a reader who had failed completely to make some division plates. I sent him some advice upon which part of this article is based. I was gratified to receive a letter from him some time later in which he said "The most important thing you did for me was to give me confidence in my ability to mark out the circles . . . I purchased a new rule . . .". So take heart and bear in mind that a set of four plates would cost almost £80 today!

Correction to Part 1, page 646.
Second column, second line under arithmetical expression should read 221 divisions, not 21.

TENTH INTERNATIONAL MODEL LOCOMOTIVE EFFICIENCY COMPETITION

FOR STEAM LOCOMOTIVES OF 3½ in. AND 5 in. GAUGES

TO BE HELD ON THE GUILDFORD MODEL ENGINEERING SOCIETY'S TRACK AT STOKE PARK, LONDON ROAD, GUILDFORD, SURREY

ON SUNDAY 9 JULY

commencing at 0900

ADMISSION 30p per person — Free Car Park

Refreshments available at the track all day

Mr. Martin Evans, formerly Editor of the Model Engineer, will present the prizes

Spectator tickets for I.M.L.E.C. are available from Model Engineer's offices, price 30p

JEYNES' CORNER

Old time lifts

THE POWER OPERATED LIFT or hoist is very old, nearly all the old wind and water mills used what were known as sack hoists, the power being used to hoist the load up, a bob weight above the hook then returning the hook by gravity. Probably some of the more adventurous souls stole rides on them, generally however, the idea of passenger-carrying lifts did not come to fruition until well into the 19th century.

Many warehouses, where no power was available, used hand turned lifts, but the cotton and woollen mills were generally equipped with lifts powered by the shafting. These, generally, were of two types, the one system employing a single worm drive, the other using spur gearing for the necessary reduction. Where the single thread worm was used, the lift was often not fitted with a brake, as the slow pitch of the worm was self sustaining. A brake was however absolutely necessary where spur gearing was employed to prevent runaways.

The power was applied in the same way for both systems, two belts, one open and one crossed, in the same manner as the belt-driven planing machines, but both having the same reduction ratio, unlike the planer which had a quick reverse movement. Control was by a rope passing down through the lift, round a grooved wheel in the shaft well bottom, and up outside the lift to the belt shifter.

The hydraulic lift developed by Sir W. G. Armstrong was always slow moving, and there were several types in use, one being the direct lift by the ram, and in some cases, ropes and purchase pulleys were used, an eight purchase set of blocks giving a long lift, with only a short ram movement. It was expensive to install, and expensive to use, where the water had to be pressurised, and a hydraulic accumulator used.

I have seen lots of steam hoists working before the internal combustion engine took over, but I have never seen a steam passenger lift. I am indebted to an American friend for some information on these; as far as he can ascertain, the first steam lift came into operation around 1860; this was powered by a vertical steam engine belt driving the same sort of gearing previously used on the shafting driven types. The reversal of direction of travel was however made by the use of link-motion reversing gear on the engine and no brake was fitted, as the worm thread angle did not exceed 10 or 12 degrees, so was considered to be self-sustaining. The engine was on a separate concrete foundation, and later the engines were mounted on the same bedplate as the hoisting gear, a much wider belt being necessary, also a tensioning pulley, as the drive was so much shorter.

Where spur gearing was used, modifications had to be introduced, as it became unsafe to use link-motion as a reversing gear, as the stretching of the control rope, wear of bearings, etc., allowed steam to be given to the engine, when the link had not reached mid-gear, which was the method of stopping the engine; several unhappy events had proved that the link-motion was unsuitable, and was in fact dangerous.

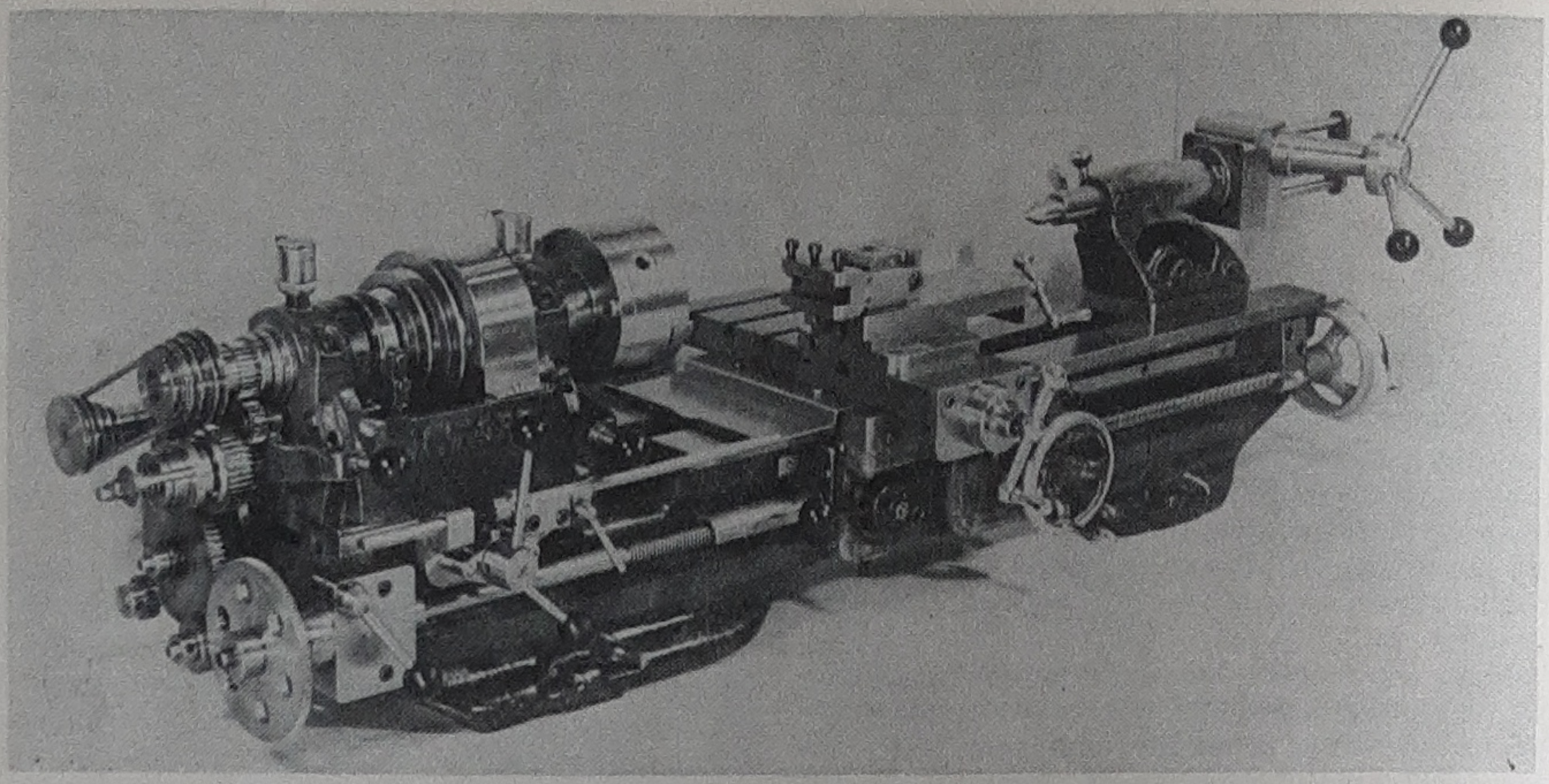
The Otis Company designed a special valve gear for their lifts for passenger service which allowed the reversal of the engines which were "Duplex" with cranks at 90 degrees, without employing link-motion. The cylinders had a specially designed valve chest common to both cylinders, and had a sliding plate between the slide-valve, which was operated by only one eccentric, and the port-face. These plates were at right-angles to valve travel, and were operated by rack and pinion. Each plate had two sets of ports, one lot straight through giving normal running, the other set of ports were transposed, giving steam to the opposite ends of cylinders thus reversing the direction of rotation. The blank space between the sets of ports was wide enough to accommodate slackness of rope, wear of bearings and joints, etc., completetely blanking off the steam and exhaust ways.

The shaft which carried the pinions operating the slides was also connected to the brake, giving "steam off, brake on", "steam on, brake off" working. The Otis Company later changed their design to a kind of piston valve working, instead of the slides, the steam passages being in the cylinder casting instead of in the valve. Observant readers will at once notice that this idea had some relation to the steering engines of steamships requiring an instant reverse; although the steering engines were a more simple job, not being encumbered with brake gear etc. in the manner the lift engine was.

Where worm gearing was used the single thread worm, while capable of sustaining the load, was soon to give way to two and three start worms which allowed much faster speeds.

Although my informant stated some steam-operated lifts were in use at the turn of the century, I very much doubt if any exist today outside a museum. The duplex cylindered engines were usually of 6 to 9 in. bore by 8 to 10 in. stroke, with a normal full speed of around 200 r.p.m.

In conclusion, I would say that the advent of the electric passenger lift sounded the death knell of the power-driven, steam, and hydraulic lifts.



WORKSHOP TOPICS

The above photograph shows Martin Cleeve's lathe as it is today. Note the 127 tooth gear on the leadscrew and the travelling chip tray on the saddle. In this article Martin Cleeve looks back over 23 years

I SEE IT WAS 23 years ago that I put my ML7 into service and "Towards the Ideal Lathe" was published in *Model Engineer* for 6 January 1955. The ML7 was my second lathe: the first was a Myford ML4 (£10 with phosphor bronze headstock bearings, *circa* 1937)—a simple basic lathe that gave excellent service in all respects except one, and that was that the headstock bearings had to be renewed every 12 months or so—but I no doubt overloaded it somewhat. Nevertheless I expect many beginners would be more than satisfied with a similar basic machine now we have reached the stage where belt guards and built-in countershafts cost more than a complete lathe used to. It seems that the days are over when one could buy a basic lathe, rig up a bit of countershaft with a couple of ball races from the breaker's yard, mount them in wooden plummer blocks and drive with a discarded washing machine motor. I was fortunate with my ML7: I was able to buy it without countershaft, belt guards and so on, and my purpose-built stand with overhead countershaft, built for the ML4, was ready to drive the ML7.

Long term readers will recall that I made many modifications to the ML7 before putting it into service and will perhaps be interested in hearing how these fared. New readers will also no doubt be intrigued.

Little did I know, though, that at the time of making the modifications I would, in later years, and in common with many others, be made redundant from a regular job I had had for 40 years, or that the modifications would so raise the efficiency of the lathe that it would form the chief instrument for earning a living. Indeed it turned out that redundancy was one of the nicest things that ever happened to me!

Centre Height

The ML7 can be seen as it is today in the photograph. Because of the sturdier construction of the ML7, the height over the cross slide was less than on the ML4, and as I wanted to continue to use certain ML4 fitments I found it convenient to raise the centre height of the ML7 by $\frac{1}{8}$ in. So my lathe is really an ML $7\frac{1}{4}$. Packing strips under the headstock and a new steel base for the tailstock settled that matter.

Back Gears

In looking at the backgear arrangement for the ML7 I perceived that if the cone pulley could be moved to the left on raising the backgear lay shaft by means of the handlever, change to or from backgear would be virtually instantaneous; so this was done, and at the same time the opportunity was

taken to replace the cast-iron backgears with steel —chiefly as a precaution against breakage when removing obstinate chucks. I also replaced the die-cast mandrel pulley with steel—a move which proved very fortunate because after the 23 years, even the steel pulley on the small step is showing pronounced wear: vee belts have started to reshape the original Vee form! The drive pulley on the countershaft is also of steel, and with considerably increased diameters, so that when the small step is driving the largest on the lathe, the belt cannot slip. The backgear lay shaft is drilled through, so that grease can be fed to the gear boss through a nipple at the exposed end of the lay shaft below the spindle nose.

Rack and Pinion Tailstock

Having fitted a rack tailstock mechanism to the ML4 and found it an invaluable time-saver, I felt I could not very well do without a similar arrangement for the ML7—but for the new assembly I "skewed" the rack at an angle of 22½ degrees off right angles so as to give more space between the capstan levers and the top-slide. The first tailstock barrel was made from a length of 1 in. dia. silver steel, drilled through 17/32 in. and provided with a No. 2 Morse taper, and an ejector rod permanently in place. This knocks out centres, drill chucks and so on by smartly retracting the barrel. Not so many years ago I found that the barrel appeared to be a little too free in the tailstock bore and I was fortunate in finding a length of nominal 1 in. dia. silver steel one thou oversize, so with this I made a new barrel with every satisfaction.

Barrel Lock

I have heard it remarked that without the self-locking action of a screw feed tailstock there would be a loss of security when turning between centres. Not so. When turning between centres or between chuck and centre (with a chuck back stop) I have always found the thumb-lock perfectly adequate—in fact I often notice a "grunt" on release of the barrel lock because it has been holding against the very significant force of work expansion from heating up during machining: you could hardly have anything more secure than that, could you? Of course, what you must not do is forget to lock the barrel before commencing a cut—this you can get away with only if the barrel is screw fed!

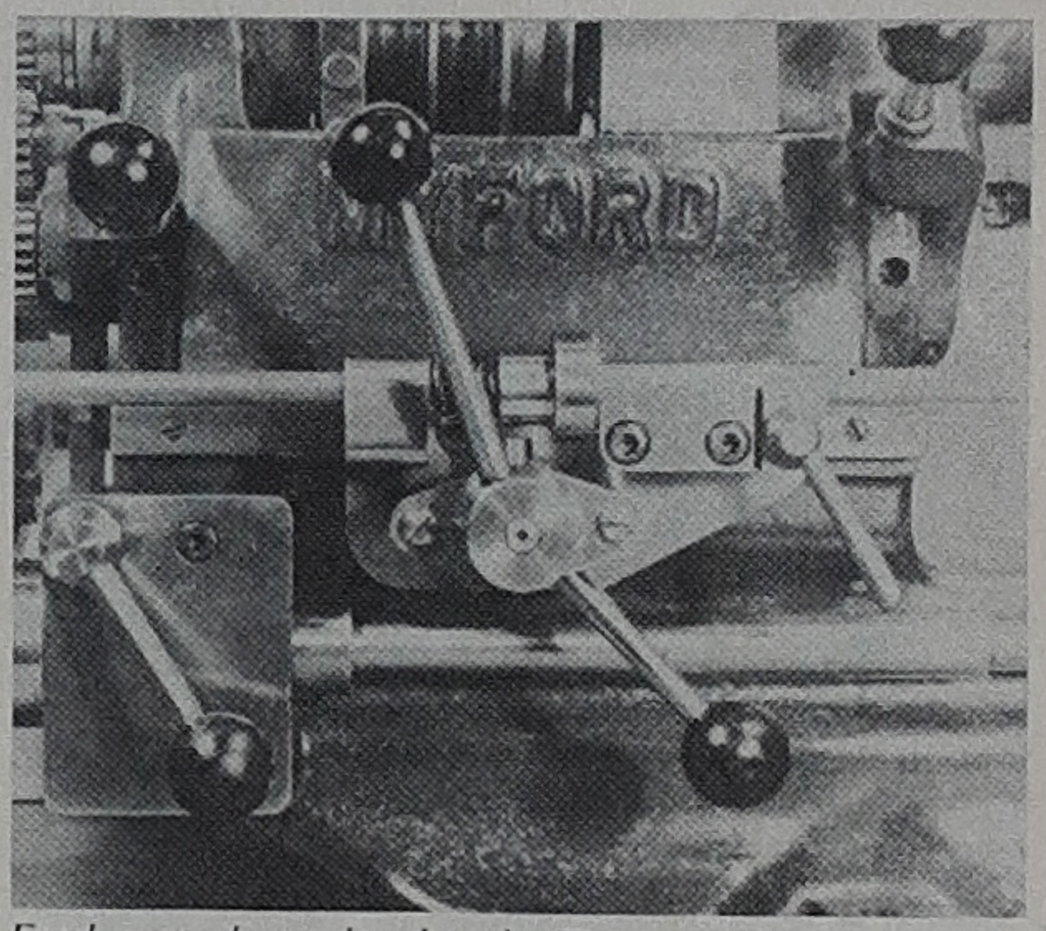
Cross and Top Slides

The cross slide is a recent special, made of steel by Myford, and has six equally-spaced T-slots, and is without a locating hole for a top-slide. The standard Myford top-slide was rejected in favour of an all steel fabricated construction, rotatable through a full 360 degrees and provided with a base that can be secured to any convenient pair of T-slots spaced at 3⅛ in. The new top-slide has 4 in. of useful travel.

Metric Working

In recent years I fitted metric feed screws to both cross and top-slides with dual reading dials so that working to metric or Imperial measure is equally easy. The cross feed dial is zero adjustable and of 2¼ in. diameter for easy reading. This is also provided with a Vernier scale for reading to 0.0025 mm. (0.0001 in.). The Vernier is not fitted with the idea of taking tenth thou cuts, but when a Vernier reading is *included* in a finishing cut of about 0.004 in. depth, the Vernier reading does take effect, and can be relied upon. The cross slide is now provided with means for using front and back stops when necessary. Admitted stops so fitted are apt to have a "spongy" feel—you can squeeze the odd thou in. on the dial—but they are very useful when quantity roughing because they eliminate the possibility of advancing or retracting "one turn too many".

I hope to say more about feed dials in a later article, and to show how the standard Myford die-cast extension to the cross slide feed can be fitted with a larger zero-adjustable dial.



Feed controls on headstock. The central vertical lever gives forward, reverse and neutral for self-act. The lever immediately below controls the screwcutting dog-clutch — the lever shafts (one inside the other) pass through to the rear of the headstock.

Change Gear Quadrant

The standard Myford change gear quadrant was replaced by one made from ¼ in. thick steel with somewhat extended slots. And not much caring for having to free and lock two awkward-to-get-at bolts to pivot the quadrant, I fitted a split clamp type bracket, made from mild steel with a single lever lock at the front. I also fitted front locking change gear studs as recently described.

I replaced the die-cast right-hand leadscrew bearer with one made from steel, although this no longer has to take thrust loading from the leadscrew during right-hand screwcutting or self-act feeding because I fitted a special leadscrew extension shaft with a flange at the right-hand end which bears against the leadscrew bush in the quadrant bracket or bearer. Now, when screwcutting right-hand threads or self-act feeding, the leadscrew operates in tension.

Screwcutting Clutch

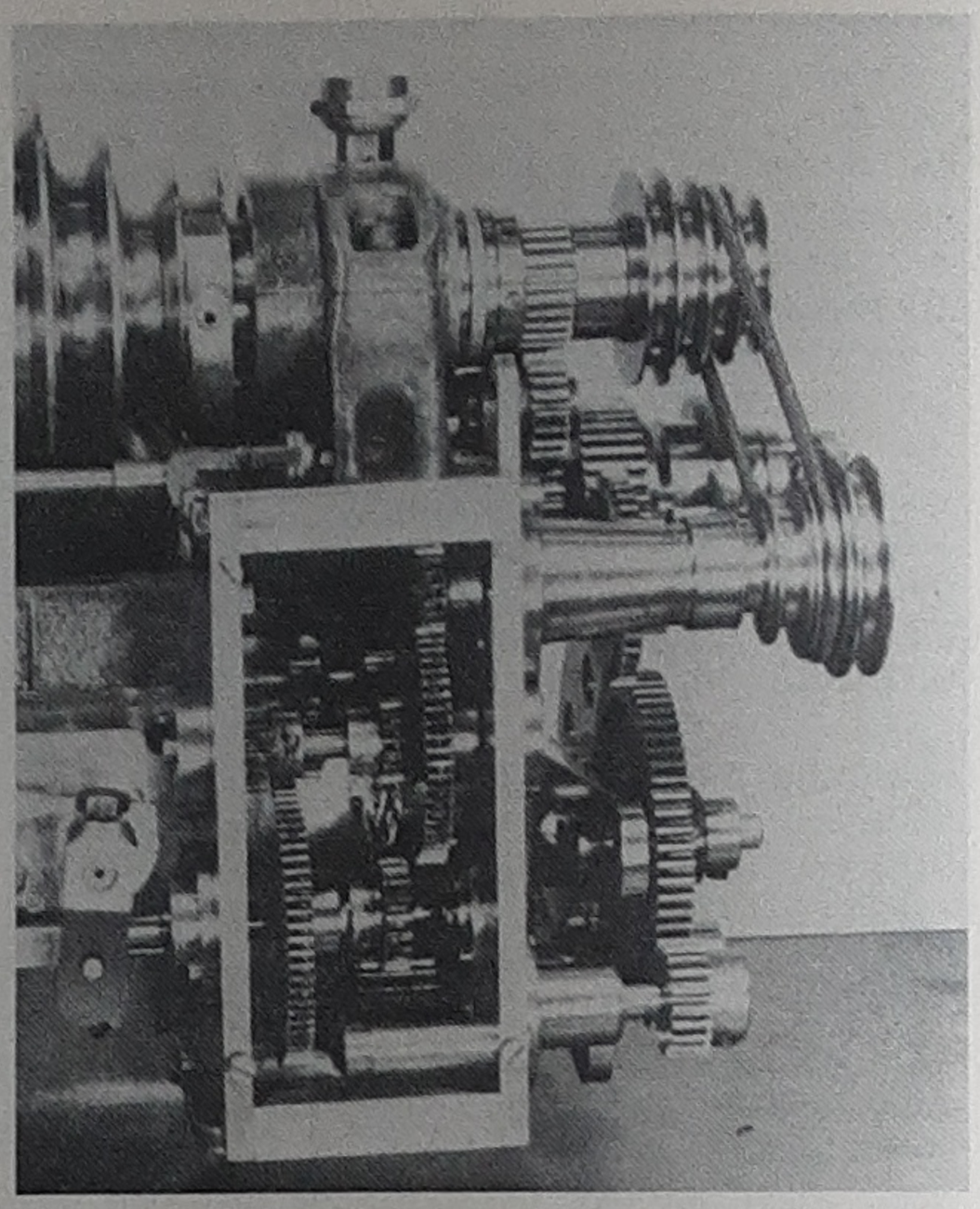
The single-tooth dog clutch fitted to the tumbler-reverse output spigot for obtaining instant repeat pick-up for all thread pitches is a fairly recent addition, and the adjustable saddle dead-stop rod that can be seen just below the headstock was made to serve also as the automatic knock-off rod during screwcutting.

Independent Self-Act Gearing

I had already made the independent self-act reduction gearbox for the ML4, so had only to transfer it to the ML7. This gearbox has a reverse cluster at the slow output end of the gear train, so reversal whilst running is possible, and exceedingly useful when boring—the trailing end of a boring tool is often sharper than the leading end, so by allowing it to cut on the way out of a bore a very good finish can be obtained: the depth of cut being determined by the amount of spring in the tool shank and by the fact that when the saddle is being drawn towards the chuck by the self-act feed it is slewed round to a different position to that which it adopts relative to the lathe bed when being pushed in the opposite direction — small though the difference must be.

There is a neutral position between the self-act reverse and this is very handy when starting a self-act feed. As you will know, the half-nuts usually manage to engage at least one leadscrew thread to the right, thus leaving a gap of $\frac{1}{8}$ in. between the cutting tool and component, so it is useful to be able to put the self-act drive into neutral, give a quick flick to the leadscrew handwheel to close the gap, and re-engage the self-act drive. This can save from 15 to 20 seconds per pass if a component is being machined in backgear, for example.

Of course, with an independent self-act drive, the tumbler reverse gears do not run for self-act feeding and are used only for screwcutting, so it is possible to greatly increase lathe spindle speeds. My top speed is now about 2100 r.p.m. and is often used for facing and centring, small drilling and for light finishing cuts with a fine feed. The headstock does warm up a bit at the high speed, but otherwise it does not seem to mind. Although by now the lathe has done many thousands of hours' work I have never had to touch the headstock bearings—something for which I am truly thankful after my experiences with the ML4!



The independent self-acting reduction gearbox shown with the cover removed. Occasionally, if the last screwcutting gear train used was a fine pitch, the 20T drive pinion (bottom right) can be changed to 30T to speed up the self-act. The drive is via the 4-step cones, and the "belt" is a length of 3/16 in. dia. No. 21 gauge spring. The original round section of the wire itself has worn to a distinct flat section during its long life.

Two Motor Drive

A two motor drive is provided, with two sets of fast and loose pulleys giving a total of 28 spindle speeds with instant change between a good range of any pre-selected pairs without stopping, or four changes if backgear is included with a stop to engage it. Other speed changes are made by shifting the Vee belts—one of the two motors drives an additional countershaft through 4-step cone pulleys. The motors can also be run in opposite directions, thus giving virtually instant spindle reverse without overloading a single motor by electrically reversing it. The instant reverse is handy for tapping small brass components which can often be threaded at 1000 r.p.m.

There is (or was) a Japanese lathe on the market whereon the leadscrew nut is in the form of recirculating balls permanently engaged with the leadscrew. When screwcutting, users are advised to slam the drive motor directly into reverse on completion of each threading pass (to arrest the traverse motion and reposition the tool for the

next cutting pass). This approach—than which I can think of few arrangements more preposterous—does ensure repeat pick-up for all thread pitches, but it must have been designed in the days when electrical power was cheap. With the drive motor of about 7 h.p. I only hope users have their maximum demand meters bolted firmly to the wall.

Recently, I found that with the new high-speed drive the lathe spindle was taking too long to slow down so I had to fit a brake to the countershaft: a virtually instant stop is now available. Headstock oil passes through a filter system and is reclaimed. I changed the drip feed "bottles" to wick oilers (pipe cleaners—with acknowledgements to LBSC).

Auto Cross Feeds

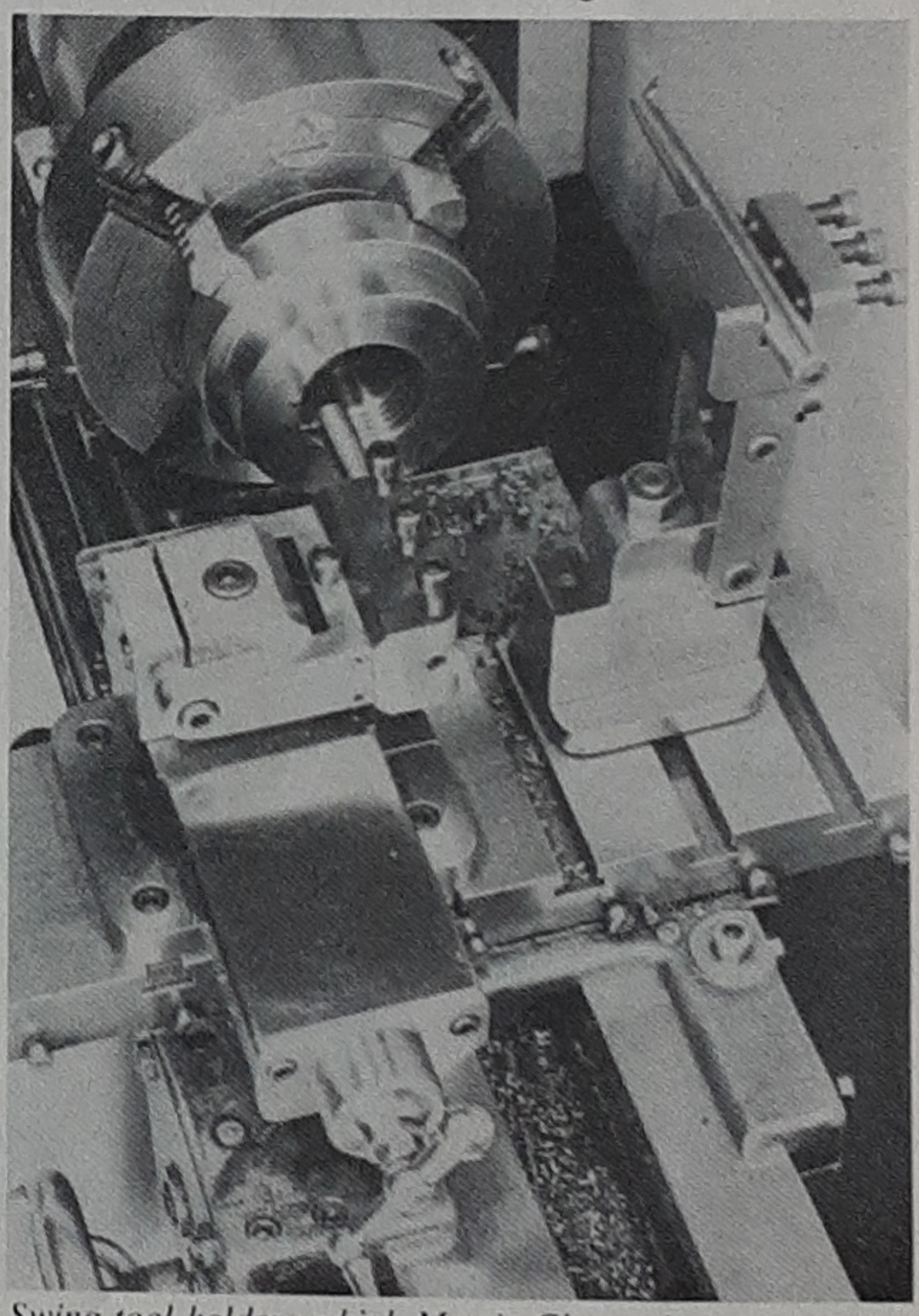
One device I have not fitted is an automatic cross feed for the reason that I don't think it would save me any time. The largest components regularly faced are of 2 in. diameter free-cutting mild steel which I can load, face with a carbide tool, and centre at 1400 r.p.m. in less than 30 seconds each. I am however open to suggestions to improve timings. You see, when facing by power cross feed, unless you want to wait, you have to make a rapid hand approach with the tool to close the loading gap between tool and component, then transfer the hand to the power feed control lever. On reaching the centre, the power feed has to be disengaged, and the hand transferred back to the feed handle to make a rapid retraction, and it seems to me that whilst making the rapid approach to close the loading gap one may as well continue to hand turn the feed handle a bit more slowly for the remaining 12 or so revolutions, especially when a rack tailstock barrel can be rapidly brought into action for centring during facing. When facing by hand, too, one can instantly vary the feed rate. More often than not, part of the faced component will be machined away later and therefore can be very rapidly dealt with, and only the portion known to remain on completion of the workpiece need be finely faced. With an auto cross feed you are limited to whatever feed rate you initially selected. Components such as bolt heads can often be simultaneously faced and chamfered by a direct plunge cut with a knife and chamfer tool in one short traverse by the saddle alone — 6 to 10 a minute with the cross feed locked. It is the time wasted in *repositioning* a facing tool that I begrudge. Lever feeds are impracticable for general lathe work.

Admittedly, my cross feed handle has a radius of $1\frac{7}{8}$ in. and I fitted this for the sole purpose of an ability to rotate it with a smooth and uniform motion—something impossible with the standard Myford small radius cross feed handle, which could only be rotated by a series of grabs, unless both hands were used. I also adjust the cross slide gib according to the work in hand, fairly slack for facing, modest drag for adding depthing increments during turning.

Of course, if you have to face a batch of comparatively large diameter cast-iron components that require slow rotation, then an auto cross feed would be an advantage because it would enable you to do something else whilst the facing cuts were taking place—but who is going to use a precision lathe for machining cast iron?

Selective Screwcutting Gearboxes

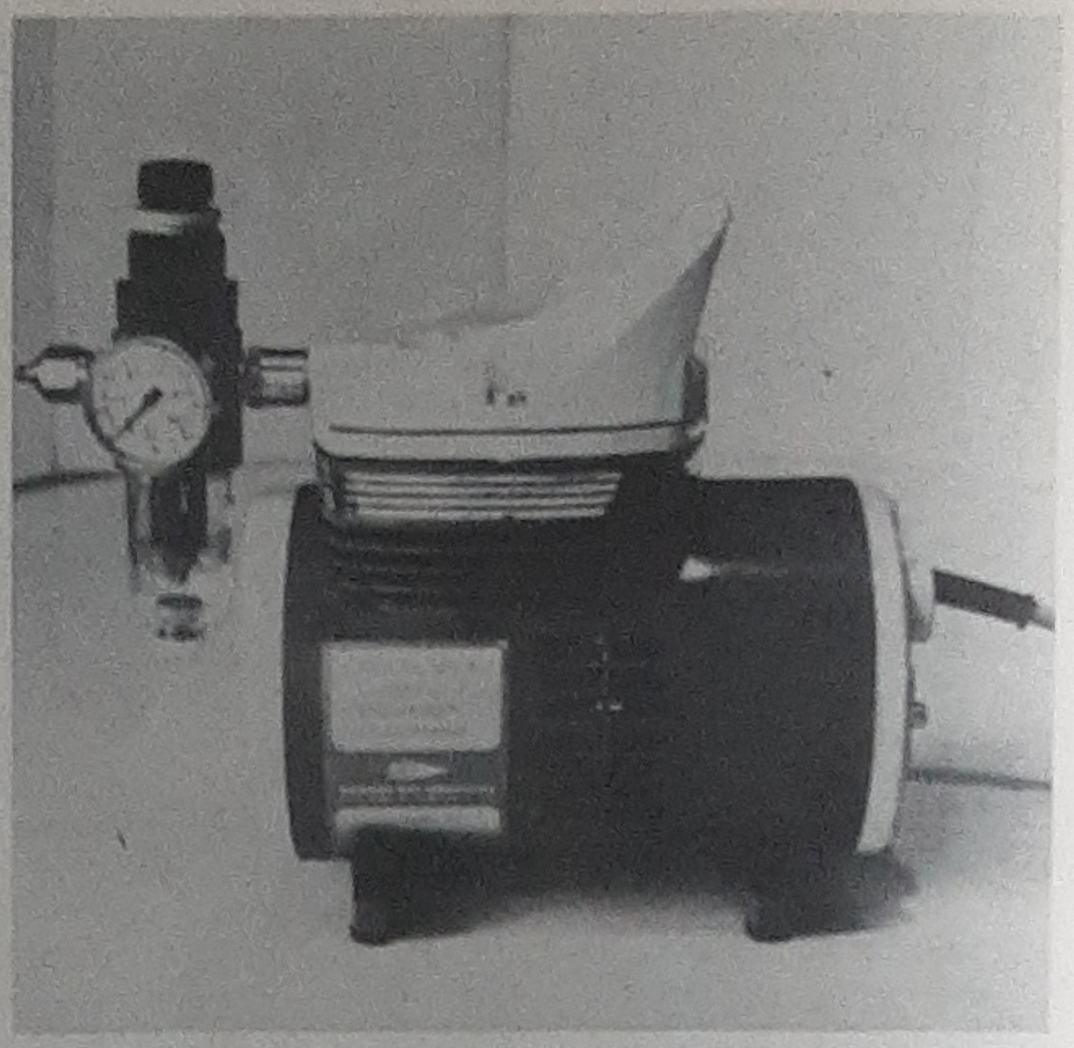
In the days when I used a lathe mostly for amusement the number of threads lathe screwcut would not have justified the cost of a selective gearbox, and nowadays I have to cut many metric threads in addition to English, so even if I had a selective gearbox I would still find myself setting up quadrant gearing for metric conversions, so there would be little advantage. Sometimes, too, I am screwcutting one pitch on a batch for several days, so the proportion of time saved by an ability to quickly set the ratio would be insignificant—especially when the independent self-act reduction gearbox ensures that self-act feeds are always immediately available regardless of any quadrant gearing last used for screwcutting.



Swing tool holders which Martin Cleeve discusses in the next issue.

WHAT'S IN STORE

Where possible, the items reviewed are seen and tested by "M.E." staff. However, where this is not possible reviews are given solely on the information received from the manufacturers and we cannot accept responsibility for products which do not measure up to the claims made for them.

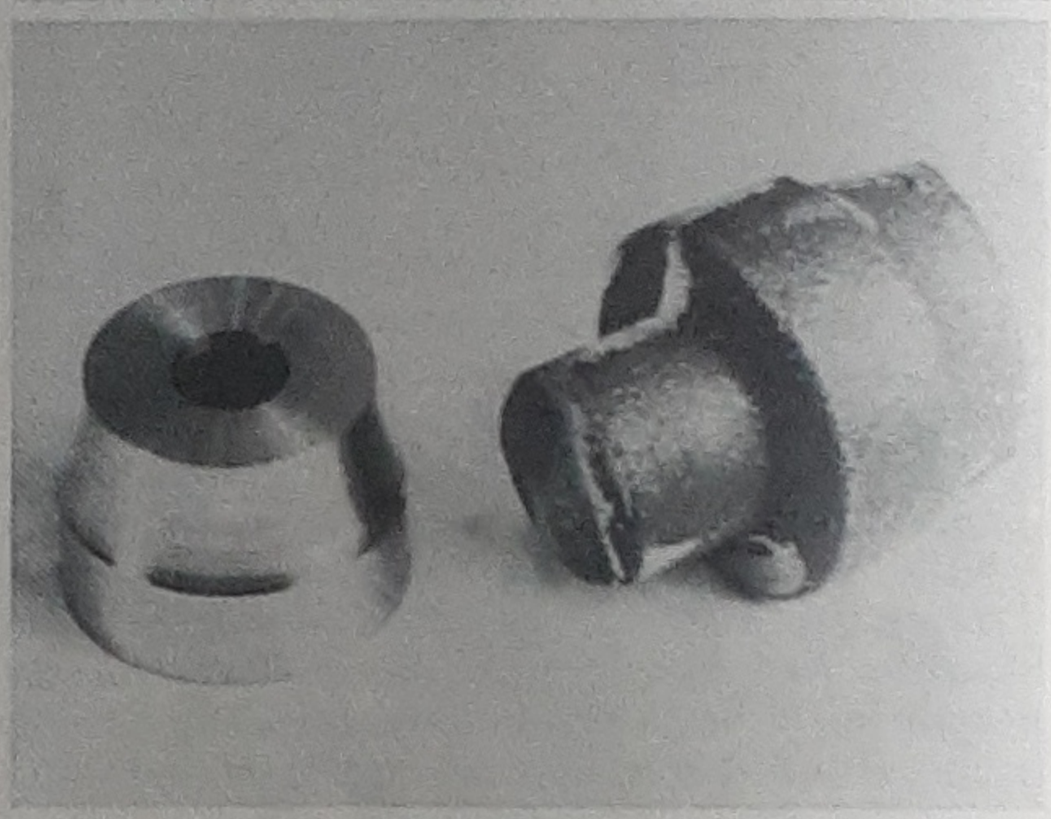


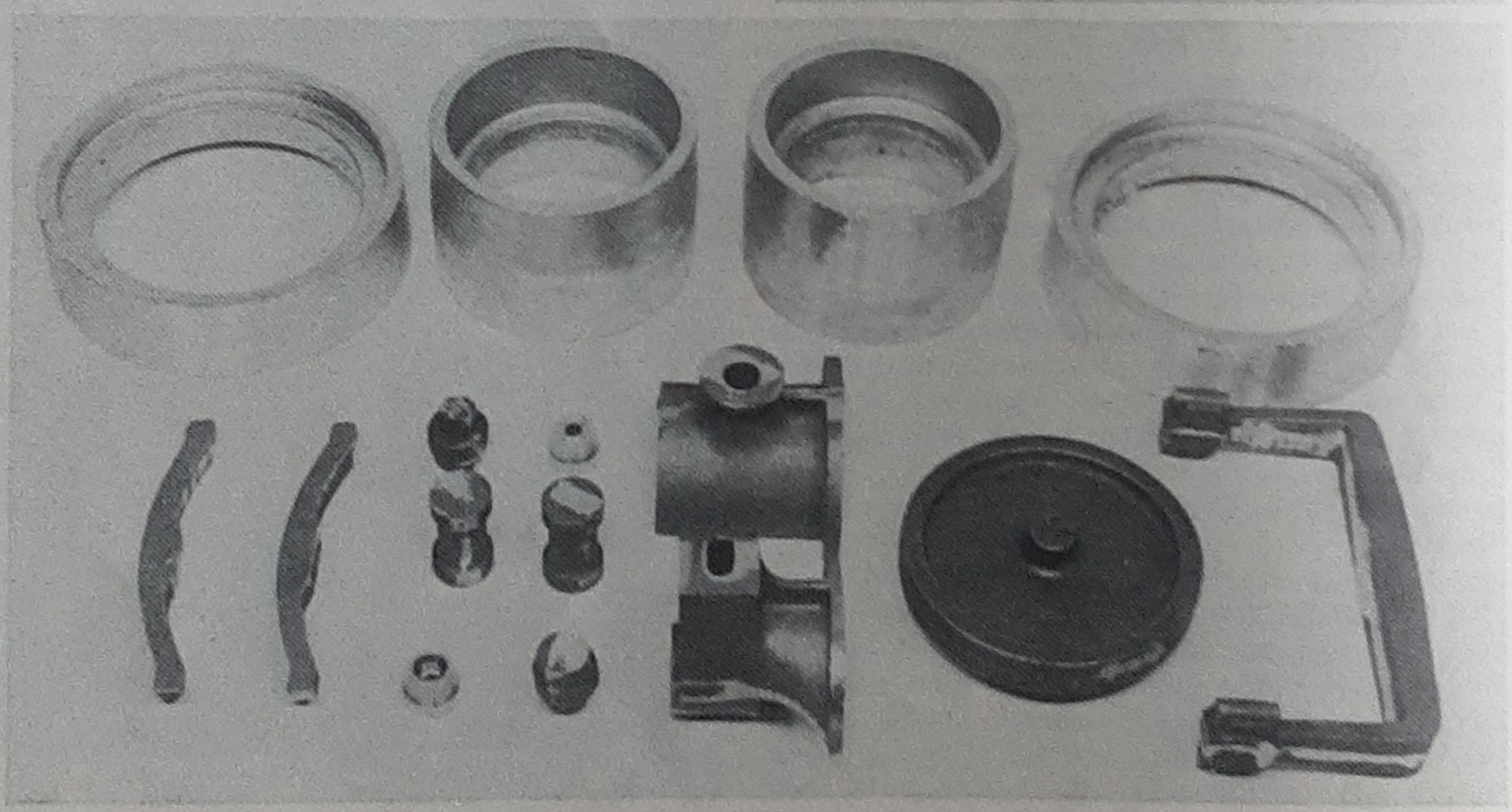
Badger compressors

Users of Badger compressors for artwork or finishing will be interested in the latest model from Morris & Ingram. Priced at £55 plus VAT the compressor is an oil-less diaphragm type with an output of one cubic foot of air per minute at 25 p.s.i. As extras a moisture trap and regulator are available at £16 and a foot switch at £6.50.

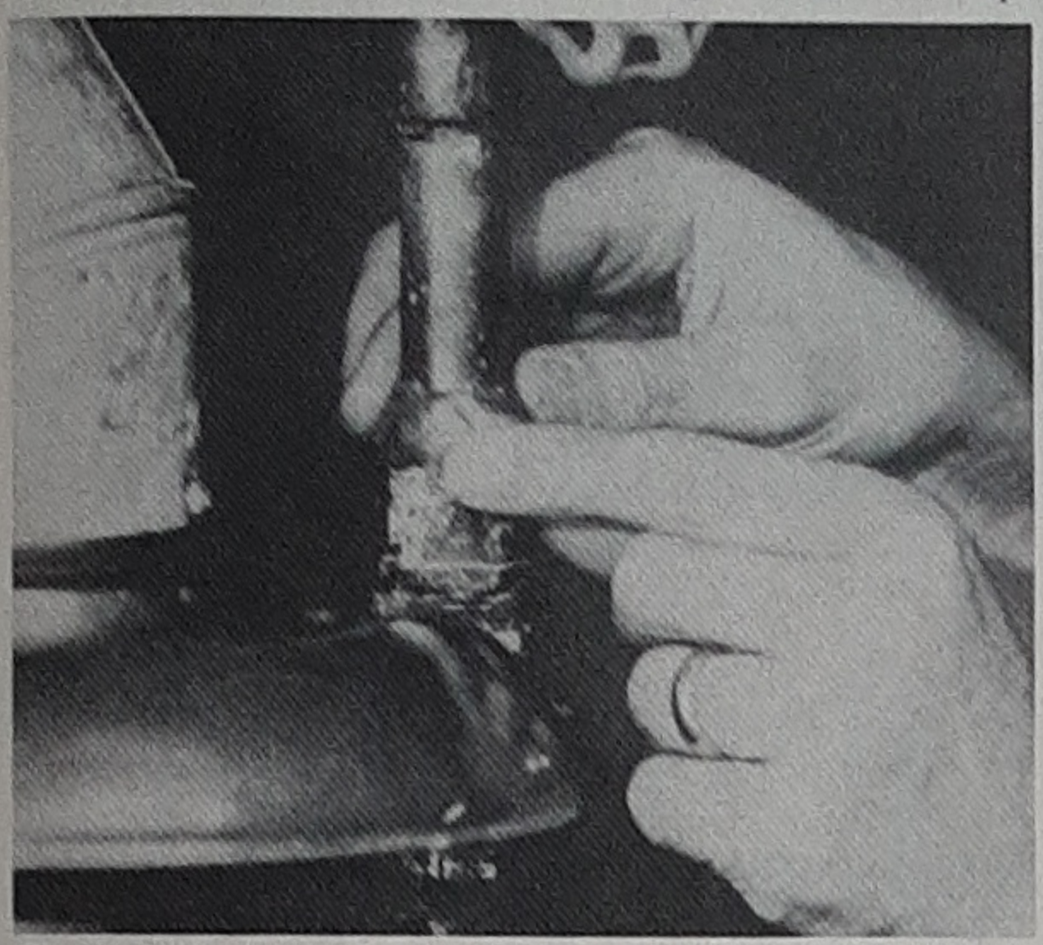
Watch this space

These photographs give a chance to kill the proverbial two birds with one stone. Firstly, the castings are of A. J. Reeves' conversion kit for "Minnie" builders who may wish to change theirs to a road roller, either during initial assembly or after building the original version. The castings are all to Reeves' now accepted high standard and are in light alloy and gunmetal. We have been fortunate in finding someone who is in the process of building "Minnie" and who has agreed to carry out the conversion while writing a descriptive article for the benefit of those readers who may require one or two points explaining. The photograph of the wheel hub already finished alongside the rough casting has another interest to readers of this page. It was turned on a new small lathe which should make its debut in the U.K. shortly. Made by Sherline Products of San Marcos, California, the lathe has a 3 in. swing although there is a metric version available. It does the usual turning operations and there are screwcutting facilities. A vertical milling attachment is also available. This is by way of being a simple introduction to a full review which will appear within the next one or two issues.

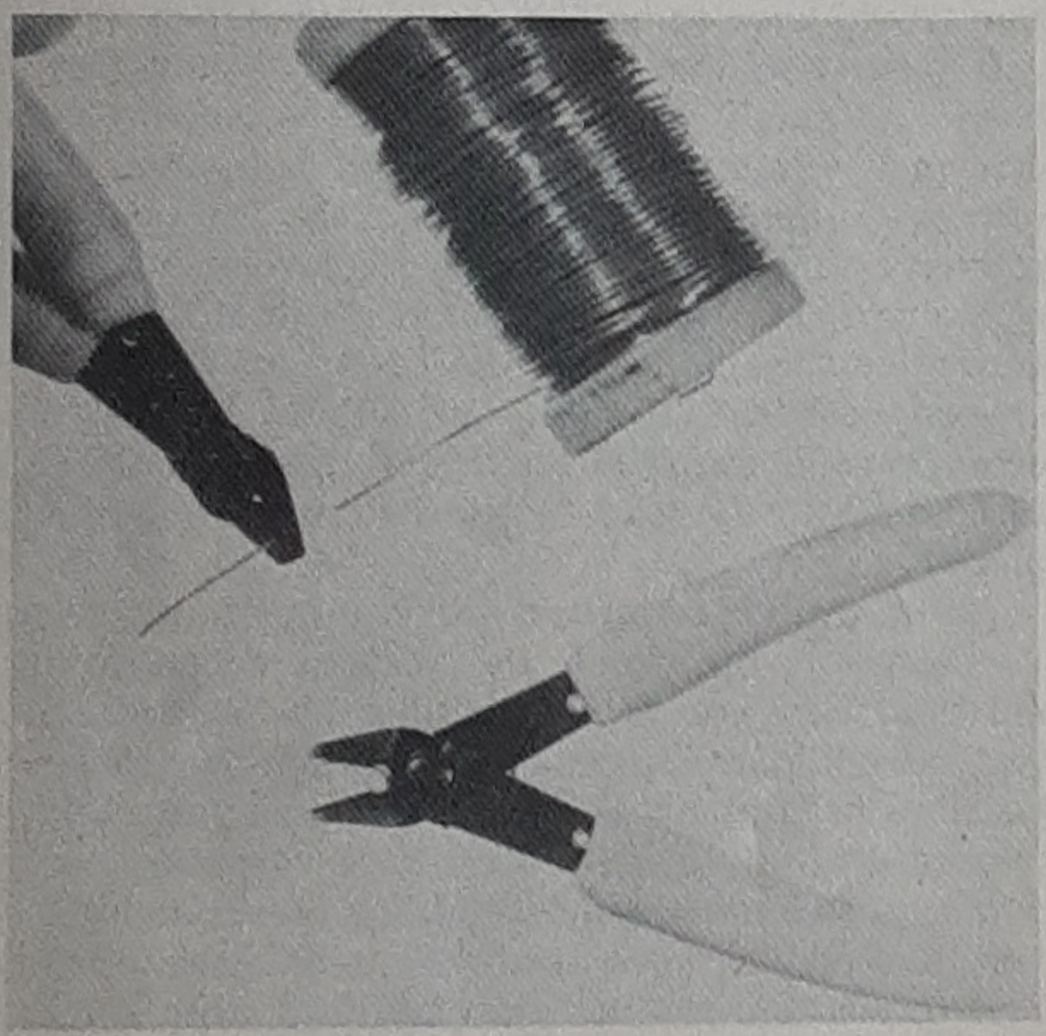




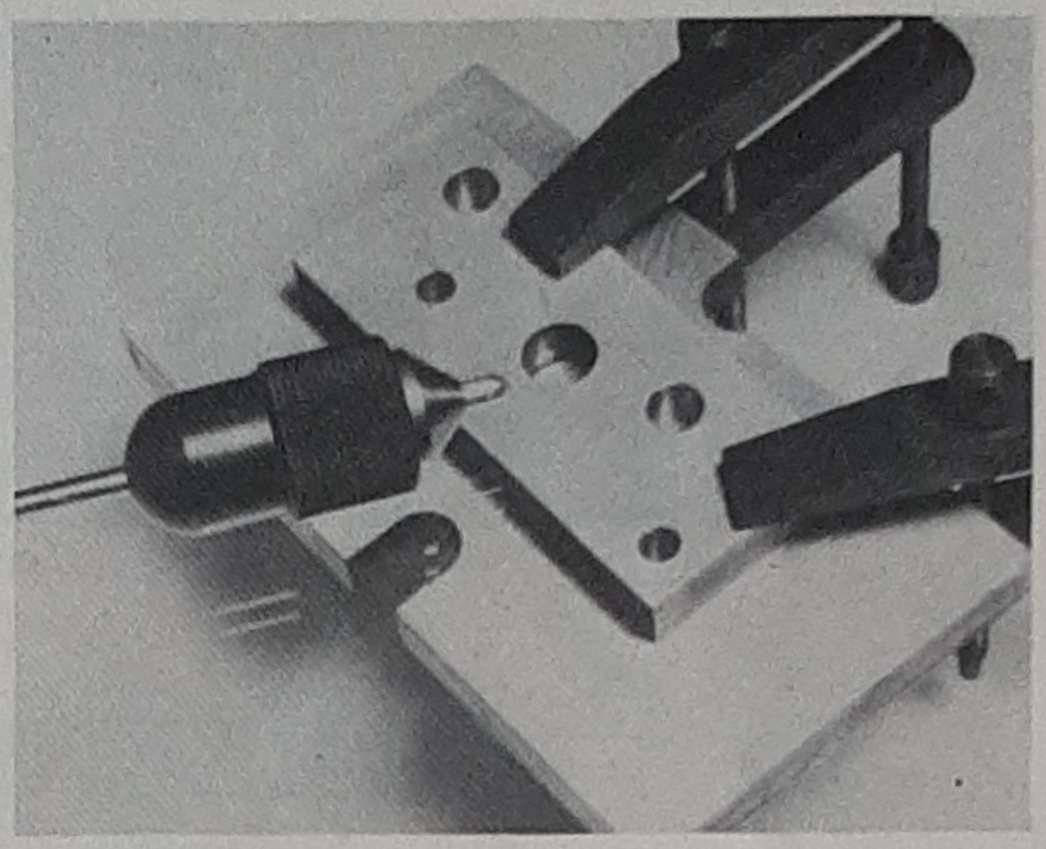
New filler/bonder
Loctite Handy Strip from the Consumer Products Division is a plastic material based on an epoxy resin which may be used to fill, bond or seal virtually any material. Handy Strip is a 10 in. length of material, one half blue, the other white which when mixed together gives the correct proportion of hardener to resin. The blue part is the resin, the white the hardener and a length to suit the job in hand is torn off and kneaded until a uniform white results which indicates the ready-for-use state, at which time the mixture will stay workable for two hours. In 24 hours the set substance will be impervious to water, oil, detergents, and other chemicals. It can be used for filling in wood, plaster or metal and is ideal for sealing pipes and tanks. It can also be used for bonding. The strip costs around 82p.



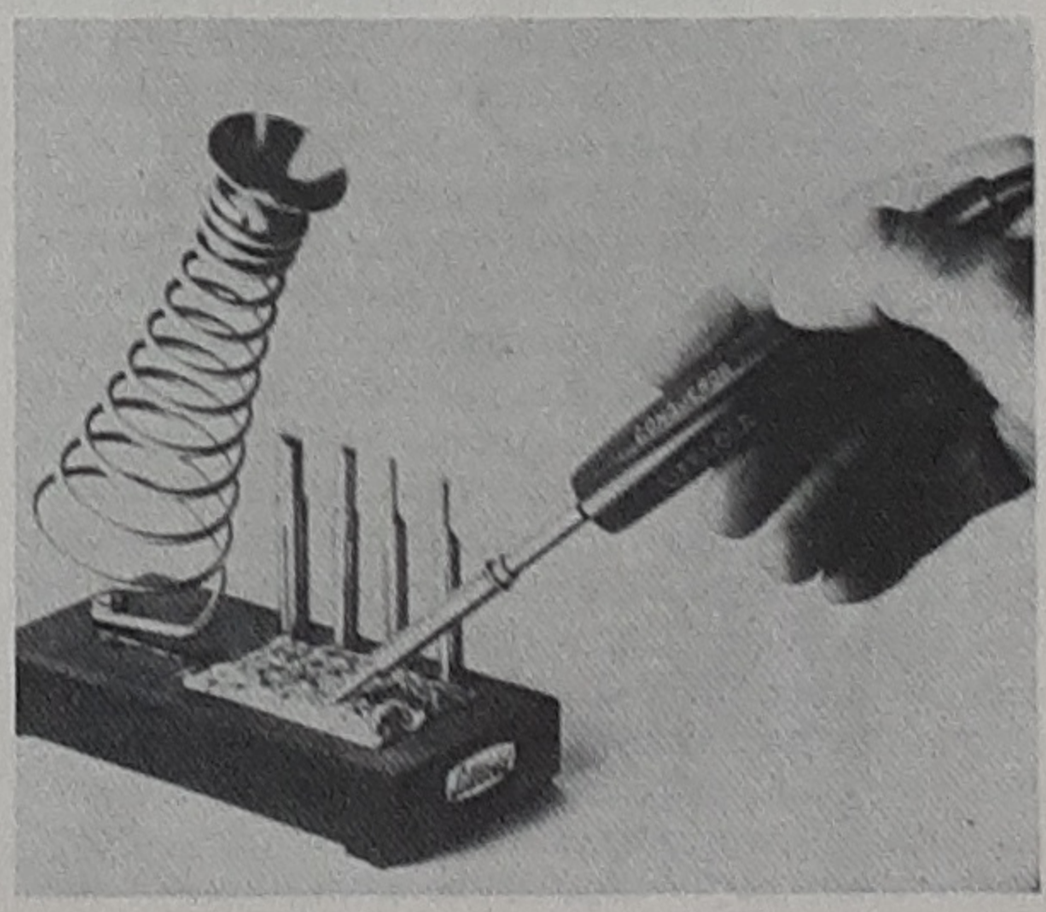
Cutting wire
From OK Machine & Tool (UK) Ltd., 48a The Avenue, Southampton SO1 2SY, comes news of the SAF 01 safety shears designed to cut wires, hard or soft, up to 1 mm. in diameter. They will also hold the cut piece after cutting to prevent pieces flying about. Priced at £2.11, the shears have bright orange padded handles for easy location on a cluttered workbench.

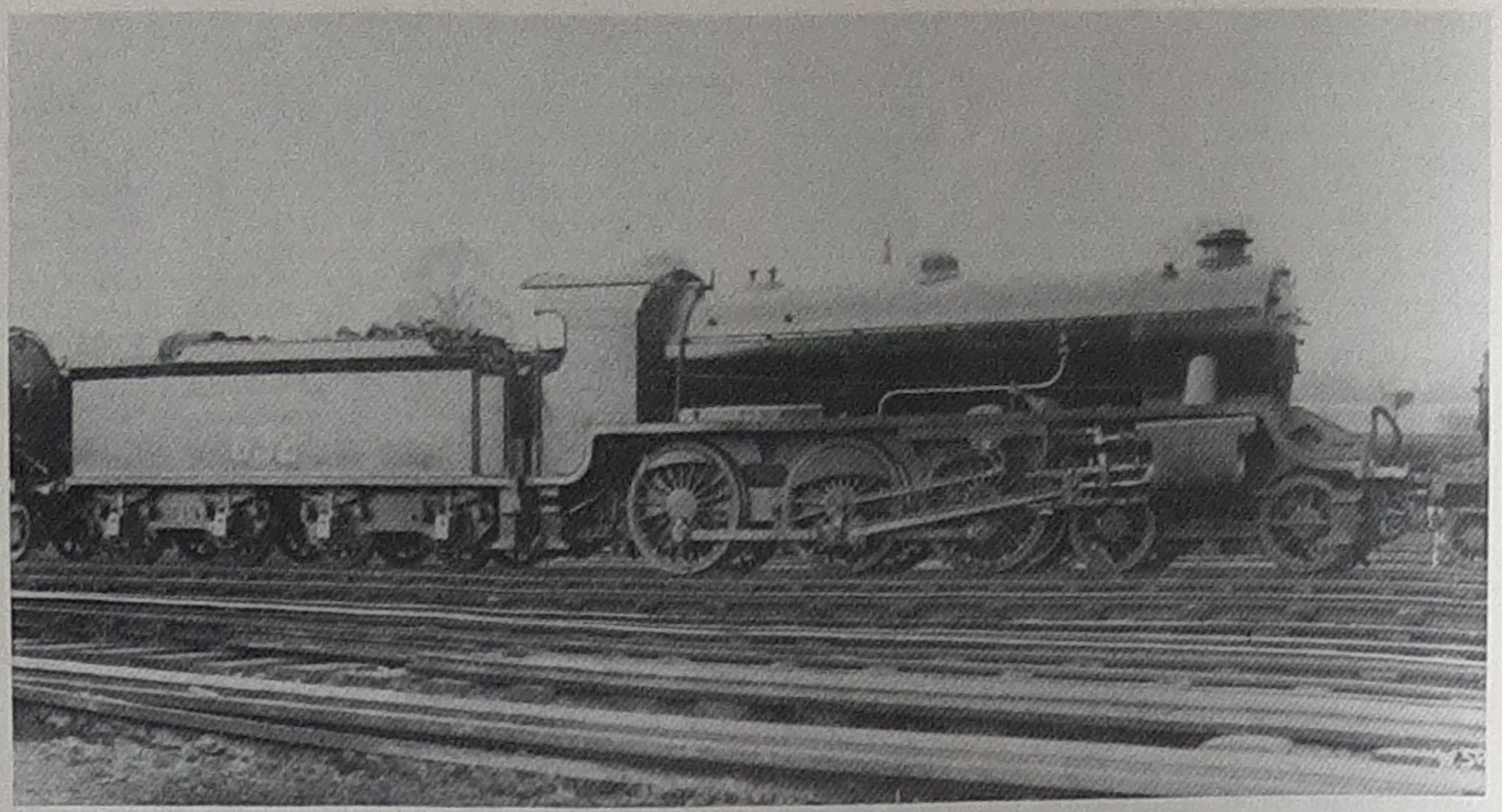


Transferring centres
Have you ever drilled, say, one frame of a loco and wished you had drilled both together to obtain true centres? From Planet Manufacturing comes a device which eliminates the need for this. Called the Transfer Centre Punch, the device is held with the hardened cone engaged in the hole already drilled with the spring-loaded outer sleeve against the face of the material. This ensures that the inner punch is perpendicular and the point of the punch central in the hole. A tap with a hammer locates the centre for the aligning hole. The device is designed for holes 5 mm. to 20 mm. in diameter. The address of the manufacturers is 10 Northumberland Park, London N17 0TX.



Soldering
The name of Litesold needs no introduction where soldering is concerned but perhaps the name of Conqueror might. This is the name given to the latest 18 watt iron from Litesold which is designed to take a wide range of bit sizes and comes complete with a stand for bench mounting with safety spring holder and four spare bits. Voltage supplies can be 12, 24, 115, 220 or 240 and it is necessary to specify which is required. You can also have a burnproof lead, translucent handle, indicator lamp, detachable suspension hook, long-life bit and safety collar. They are obtainable from Light Soldering Developments Ltd., 97-99 Gloucester Road, Croydon, Surrey.





One of the S.15 class before fitting smoke deflectors. No. 832 had Maunsell type snifting valves and adjustable big-ends.

Photo — Real Photographs Ltd.

GREENE KING

A 3½ in. gauge Southern Railway 4-6-0 class S.15

by Martin Evans

Part XIII

From page 580

SINCE I WROTE the last article on *Greene King*, I have had another look at the problem of finding a suitable position and drive for a mechanical lubricator. If we put a separate union on each outside steam pipe, as suggested previously, this means that we are committed to a twin cylinder lubricator, which would be very bulky wherever placed, or alternatively, two small single cylinder lubricators, one on each side of the locomotive, with separate drivers from the expansion links.

However, one builder has suggested that a single cylinder lubricator could be used successfully, if the delivery oil pipe was led directly into the hot header, via a union fitting at the side of the smokebox. This seemed a promising approach, so the next thing was to decide on the shape and size of the lubricator itself. The usual type of mechanical lubricator has a vertical cylinder and ram, with the valve box and the delivery union below the tank. This means that if the tank is bolted on the running board in the normal way, the delivery union is below the running board, and one is then faced with the problem of leading the delivery pipe up through the running board, clear of cylinders etc, to reach the outside of the smokebox.

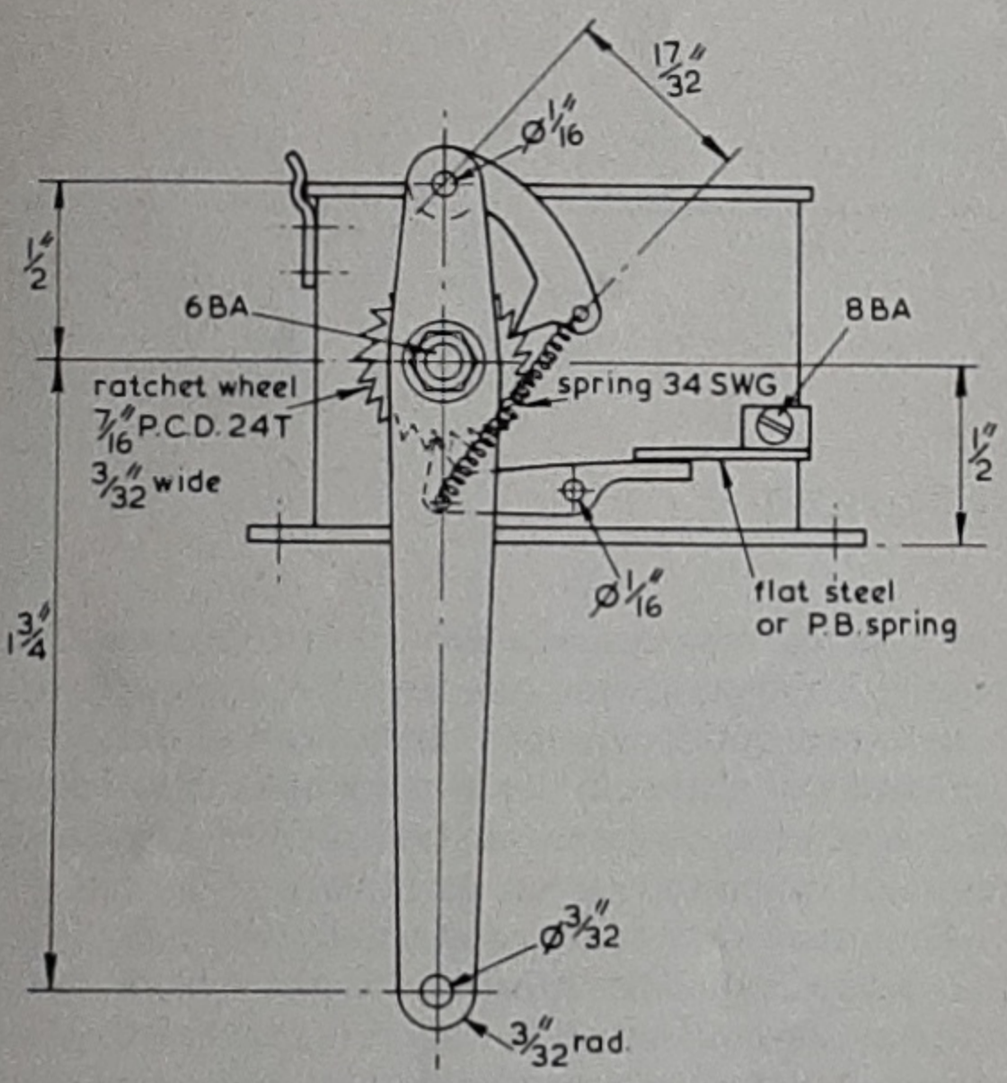
I therefore decided that a new design of lubricator was required, having the delivery union well above the base of the tank, and therefore above the running board. This meant that the cylinder and ram would have to be horizontal rather than vertical, otherwise the whole lubricator would have been impossibly high. The result is seen in my drawing. With a horizontal ram and ball valve, it is of course important to ensure that the ball re-seats properly on its seating after each "forcing stroke" of the ram. The only way to make sure of this is to spring load the ball, with the spring inside a cup-shaped member. I think one should beware of arranging the spring to bear directly on the ball as this could easily lead to the ball becoming misplaced.

Another problem arose with the horizontal ram — the shaft on which the driving eccentric is mounted now comes well within the oil level, so that oil could easily leak out through the shaft's bearings in the tank sides. To cure this positively, packed glands are needed on each side, and care will have to be taken in assembling these, owing to very limited clearance inside the tank. Perhaps the best way is to make the shaft bearings quite a light

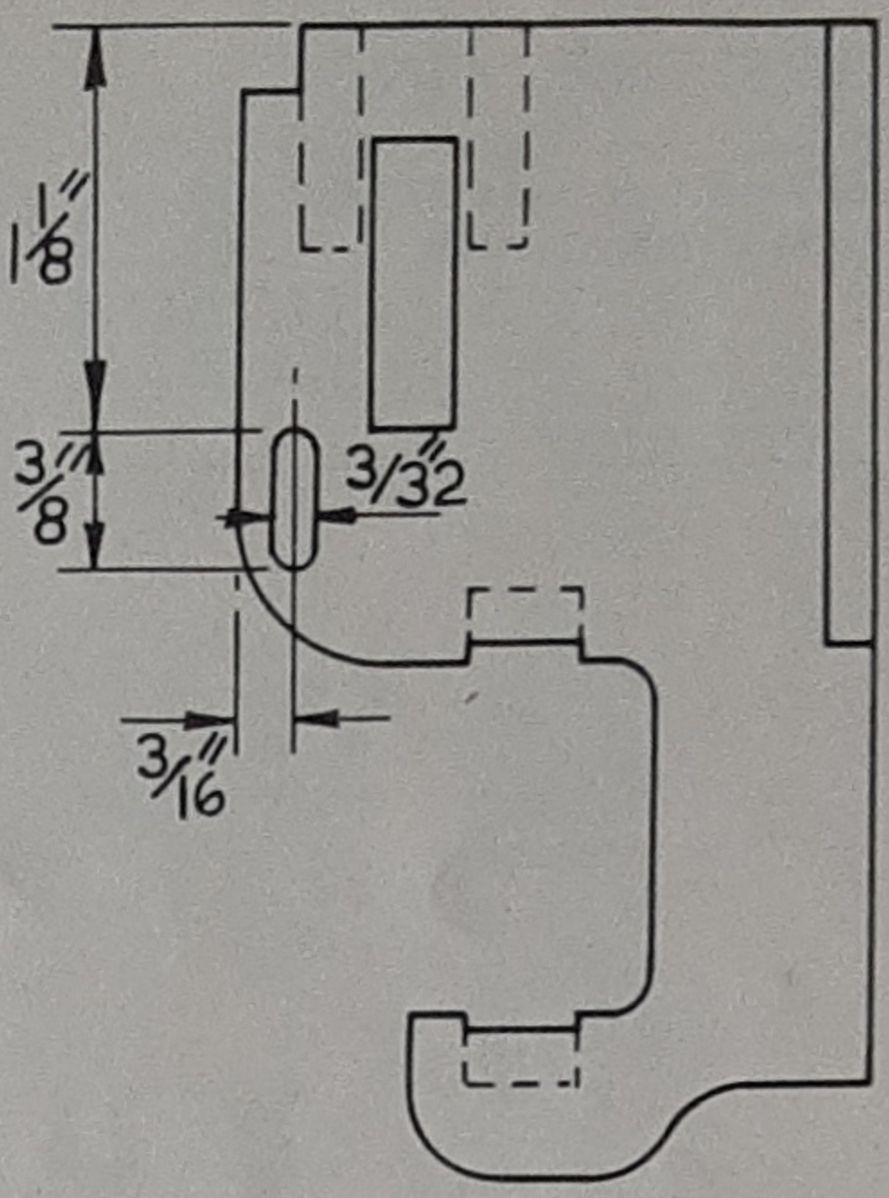
press fit in the tank sides, and to assemble the gland nuts with their graphited yarn packing on the shaft and inside the tank before the bearings are pressed home. Should the bearings turn out to be a bit on the slack side, they can always be given a touch of soft solder to seal them. The grub screw in the driving eccentric can of course be tightened from the outside.

One other problem concerned the oil inlet holes. I decided that it would be too dangerous to position one of the holes on the top of the cylinder body, as if the oil level were to fall below this point, air would be drawn in instead of oil, causing the lubricator to fail. So only three oil inlet holes are shown. Even so, it is important that the oil level must always be kept above the height of the ram. It would of course assist matters in this direction if two of the three holes were drilled at an angle to the vertical, from below, rather than at 90 deg. from the vertical.

The lubricator is mounted on the right-hand running board, and the 3/32 in. dia. delivery pipe is connected to the union fitting on the smokebox shell, from where a further 3/32 in. dia. pipe runs to the "hot" header. The union fitting may be fitted with a fibre or tufnol washer on the outside to ensure air-tightness. The drive is taken from the expansion link tail-pin. Although the driving lever could be arranged outside the motion plate, this would not look very nice, and it is really worth the extra trouble (for those builders who have already made and fitted it) to dismantle this motion plate and cut the slot shown.



LUBRICATOR RATCHET GEAR (X 2)



R.H. MOTION PLATE :—
to show slot for lubricator drive.

Brake gear

The full size S.15's like the "King Arthurs", were supplied with 24 in. vacuum cylinders, situated just ahead of the leading coupled axle, and the arrangement of the brake blocks and hangers was rather unusual, these being fitted behind the wheels. Another unusual point was that the pivot pins for the brake hangers were set very low, below the longitudinal centre-line of the coupled wheels. The front pull rod (a single rod on the centre-line) pulled on a pin in the centre of the beam connecting the hangers for the leading coupled wheels, but from there to the middle and rear beams, the pull rods actuated on the hangers instead of the beams. We can follow suit, except that the middle brake beam is omitted, so that the grate and ashpan can be dropped without hindrance.

The brackets carrying the brake cross shaft were shown in the original general arrangement drawing; they are cut from 1/8 in. b.m.s. and are fitted with gunmetal bushes of 1/4 in. inside diameter. They can be easily located by the row of three holes shown on the frame drawing (page 630, June 3 1977).

The steam brake cylinder is vertical, as usual, but this time we have to introduce the steam at the bottom, which necessitates a packed gland below the bottom cover. I expect a gunmetal casting will be available for the steam brake cylinder, and perhaps

GREENE KING

A Southern Railway 4-6-0 locomotive class S15 for 3½" g.
by MARTIN EVANS

L.O.950
sht. 7

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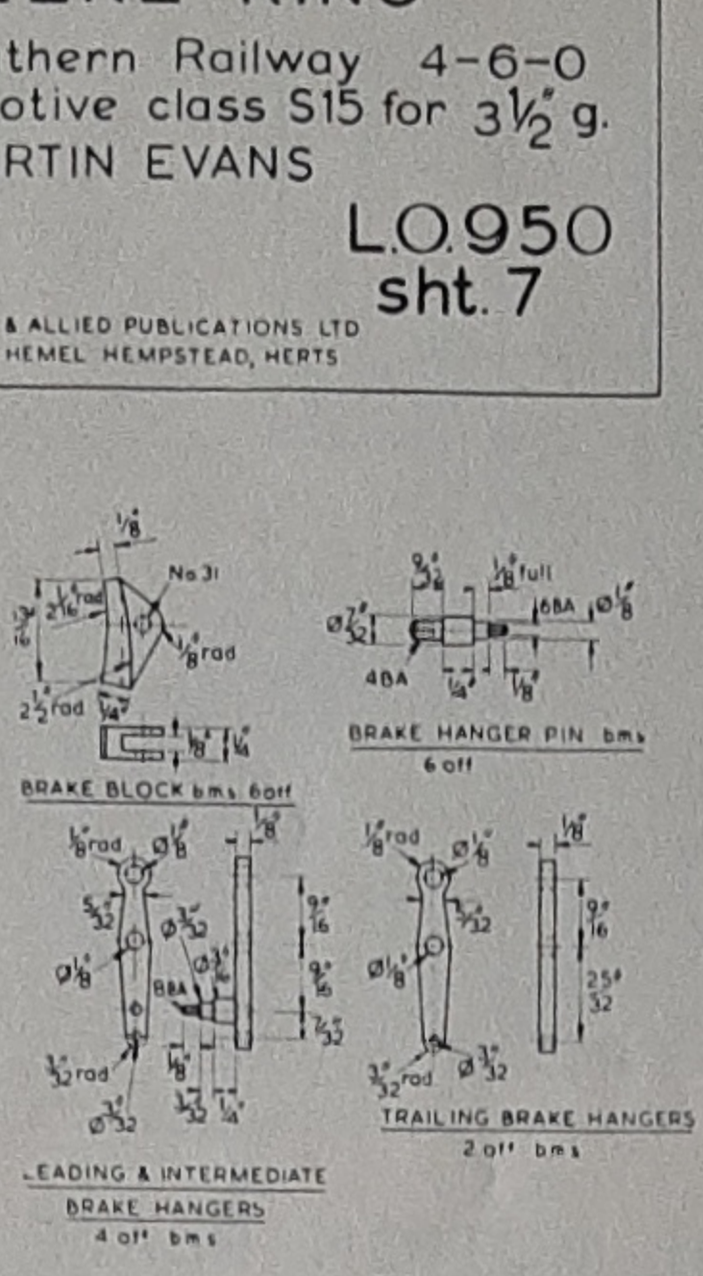
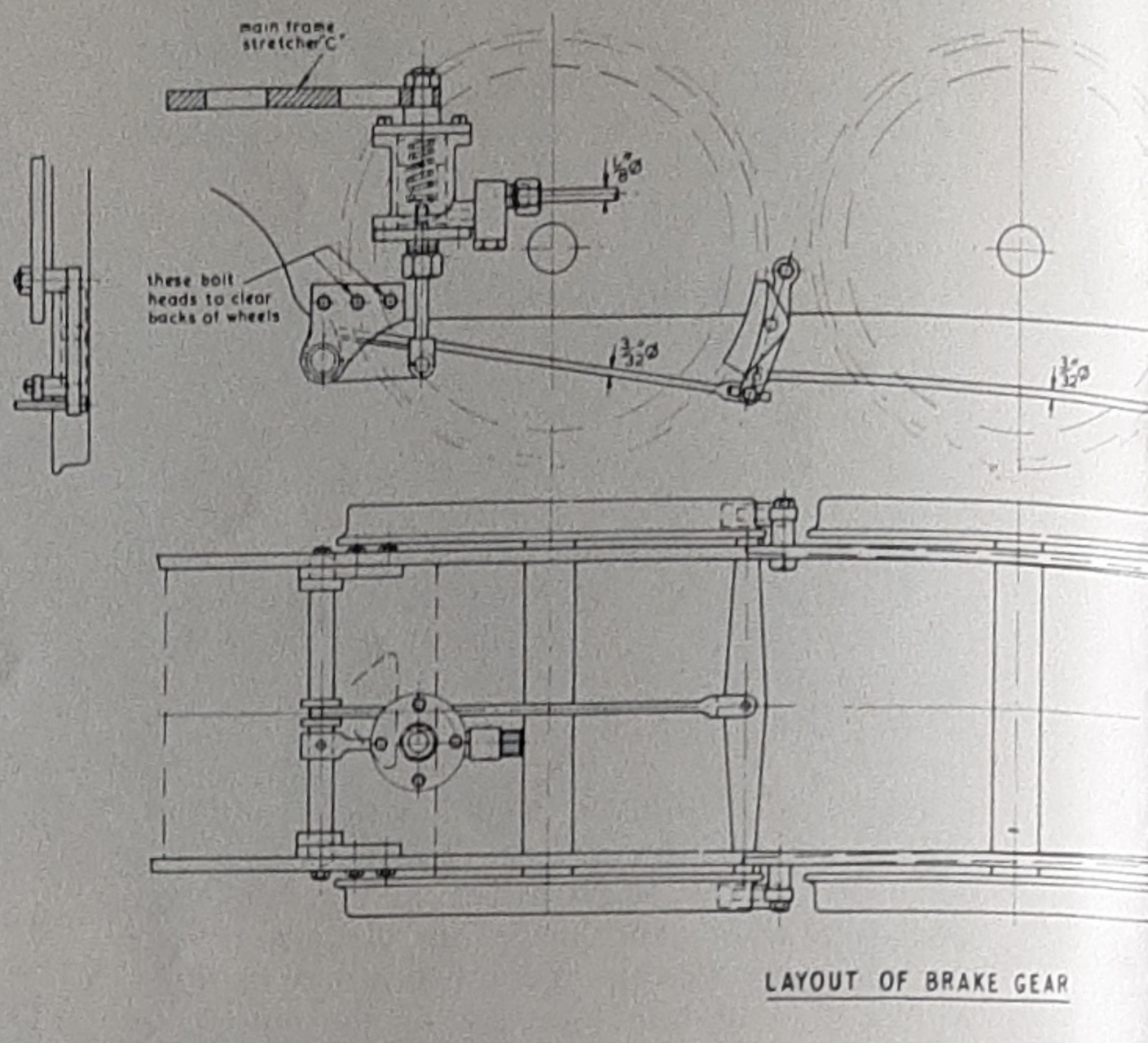
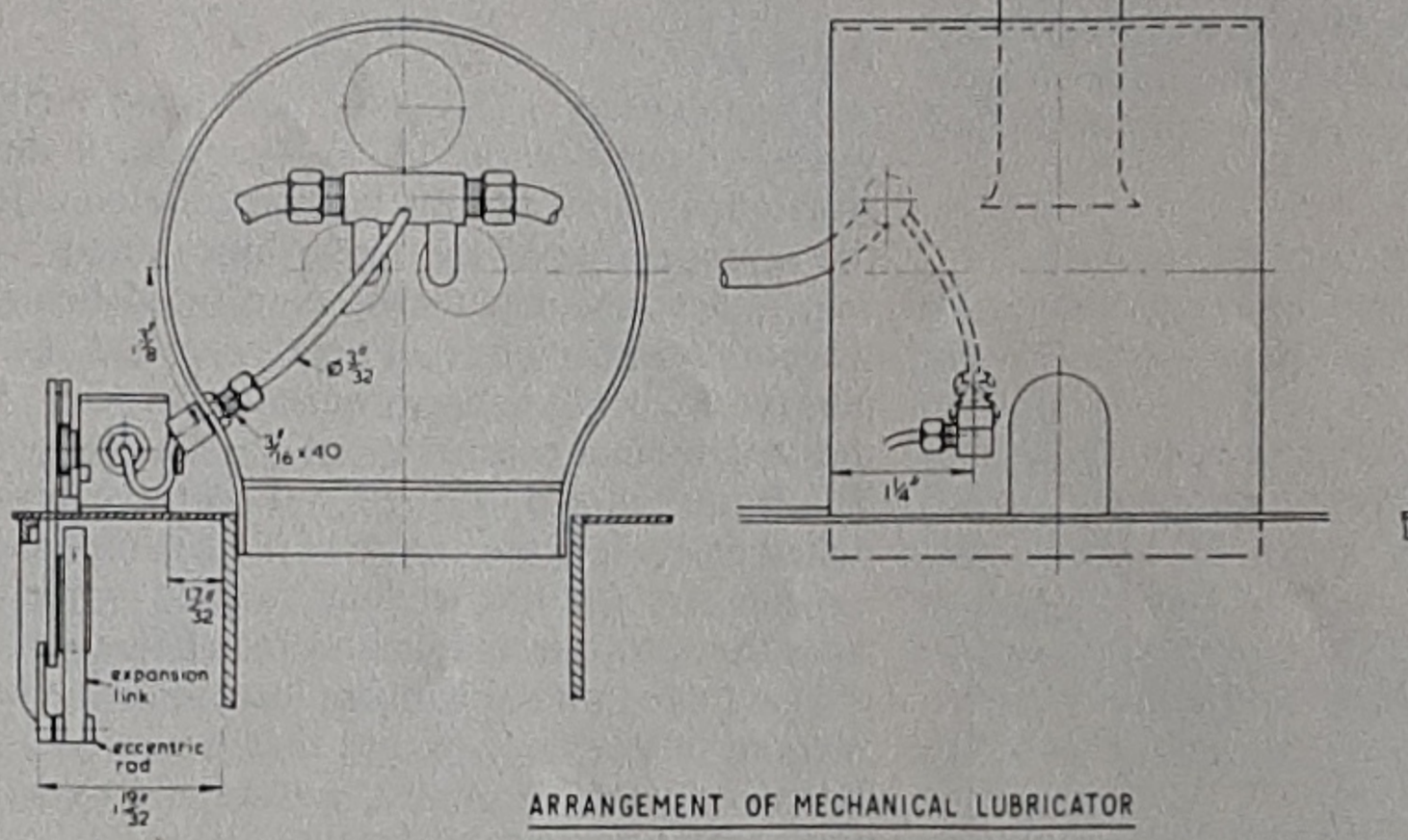
BOX 35, HEMEL HEMPSTEAD, HERTS





LAYOUT OF BRAKE GEAR

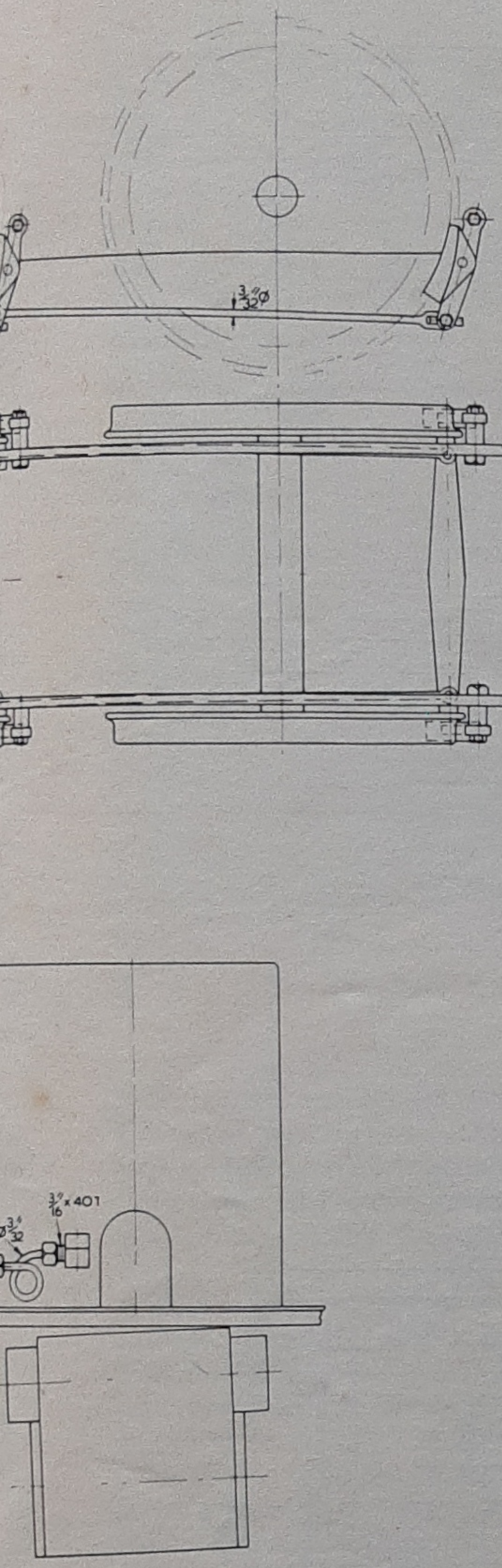


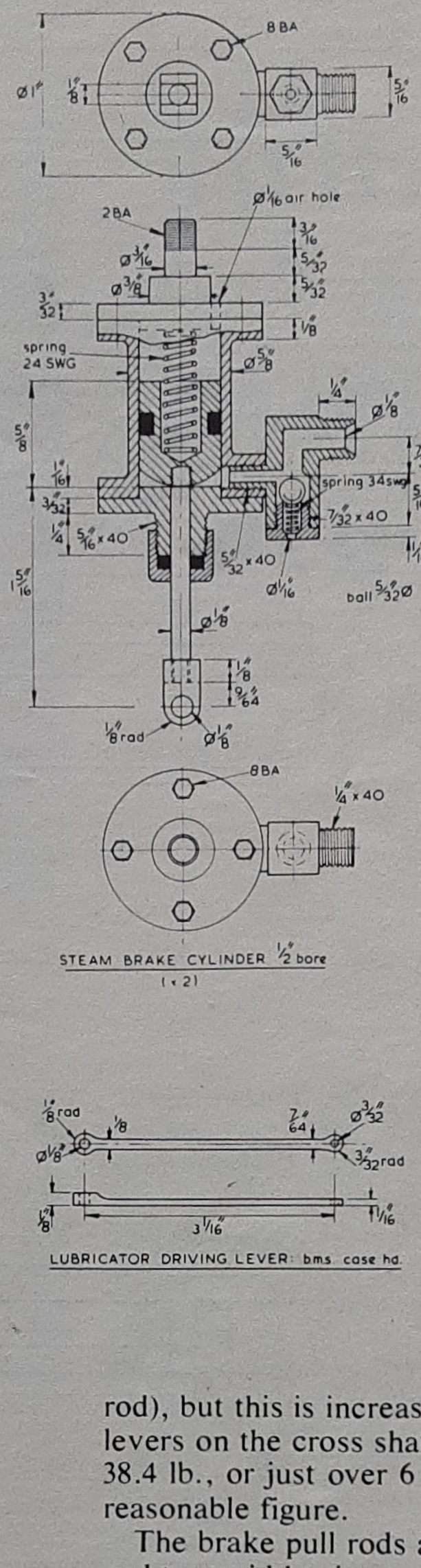
ARRANGEMENT OF MECHANICAL LUBRICATOR

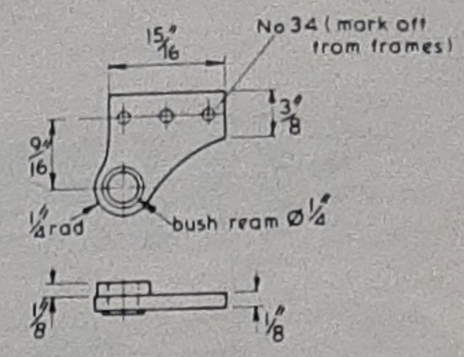
also for the top cover — I found it was unnecessary to provide a separate frame stretcher to carry the brake cylinder, for as it turned out, the main frame stretcher marked C in the frame drawing was situated just above the cylinder, so it was only necessary to provide an extension to the top cover with a short length of thread, 2 BA being strong enough, to hold the whole assembly firmly, using a hole drilled in the rear end of the stretcher.

The steam brake cylinder piston will have to be well radiused on its lower surface, to allow easy entry for the steam, and a light return spring will be required above it, not too strong, as gravity will help to return the piston to the bottom of the cylinder, and will also help the brake blocks to fall clear of the wheels. A small air hole will of course be required in the top cover, as shown.

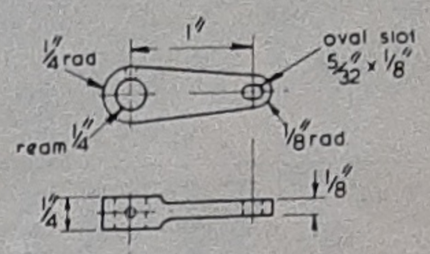
To ensure that condensed water will clear from the brake cylinder after the brakes have been released, the usual ball valve is provided. The spring, which is situated below the ball, should be strong enough to push the ball off its seating when







BEARING FOR BRAKE SHAFT: 2 off
b.m.s bush gunmetal



LEVERS FOR BRAKE SHAFT
1 off each b.m.s

STEAM BRAKE CYLINDER 1/2" bore
(x 2)

LUBRICATOR DRIVING LEVER: bms case hd.

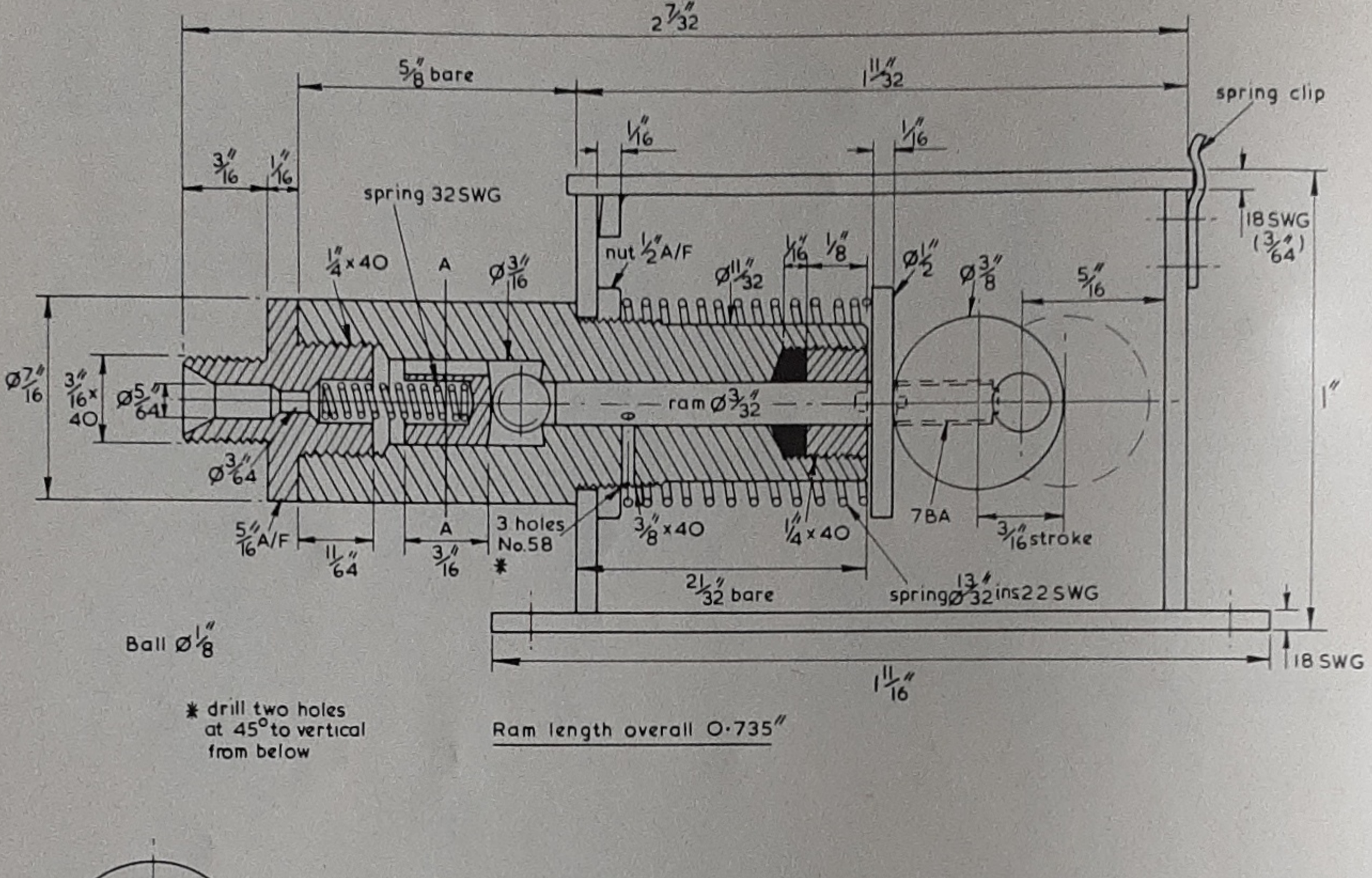
rod), but this is increased in the ratio 1:5/16 by the levers on the cross shaft, making the braking force 38.4 lb., or just over 6 lb. per brake block; quite a reasonable figure.

The brake pull rods are 3/32 in. dia. silver steel, and to avoid having to turn down much larger rod, the little forks at each end can be made separately and brazed on.

As steam brakes on 3½ in. gauge locomotives are not normally used to stop the train (for which they are generally quite inadequate in any case), there is really no need to provide compensation between each pair of hangers, or even turnbuckles with right and left-hand threads for adjustment purposes, but whether to fit these "extras" I can safely leave to the prospective builder.

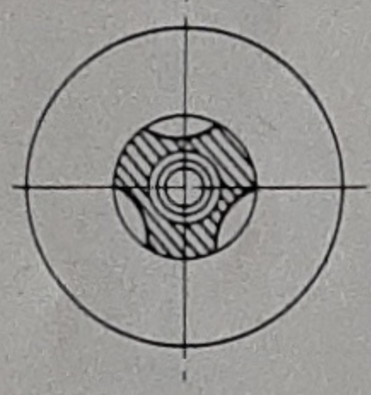
To be continued.

the steam from the boiler is cut off, but not so strong as to prevent boiler steam keeping it on its seating, with the brake applied. In the last such water release valve I made, I found a spring of 34 SWG and 1/8 in. inside diameter just right, but this will depend on the sort of pressure obtained in the valve. Incidentally, an approximate calculation shows that the total force available for braking with a ½ in. dia. brake cylinder, based on an effective steam pressure actually in the cylinder of 60 p.s.i., is only 12 lb. (allowing for the 1/8 in. dia. piston

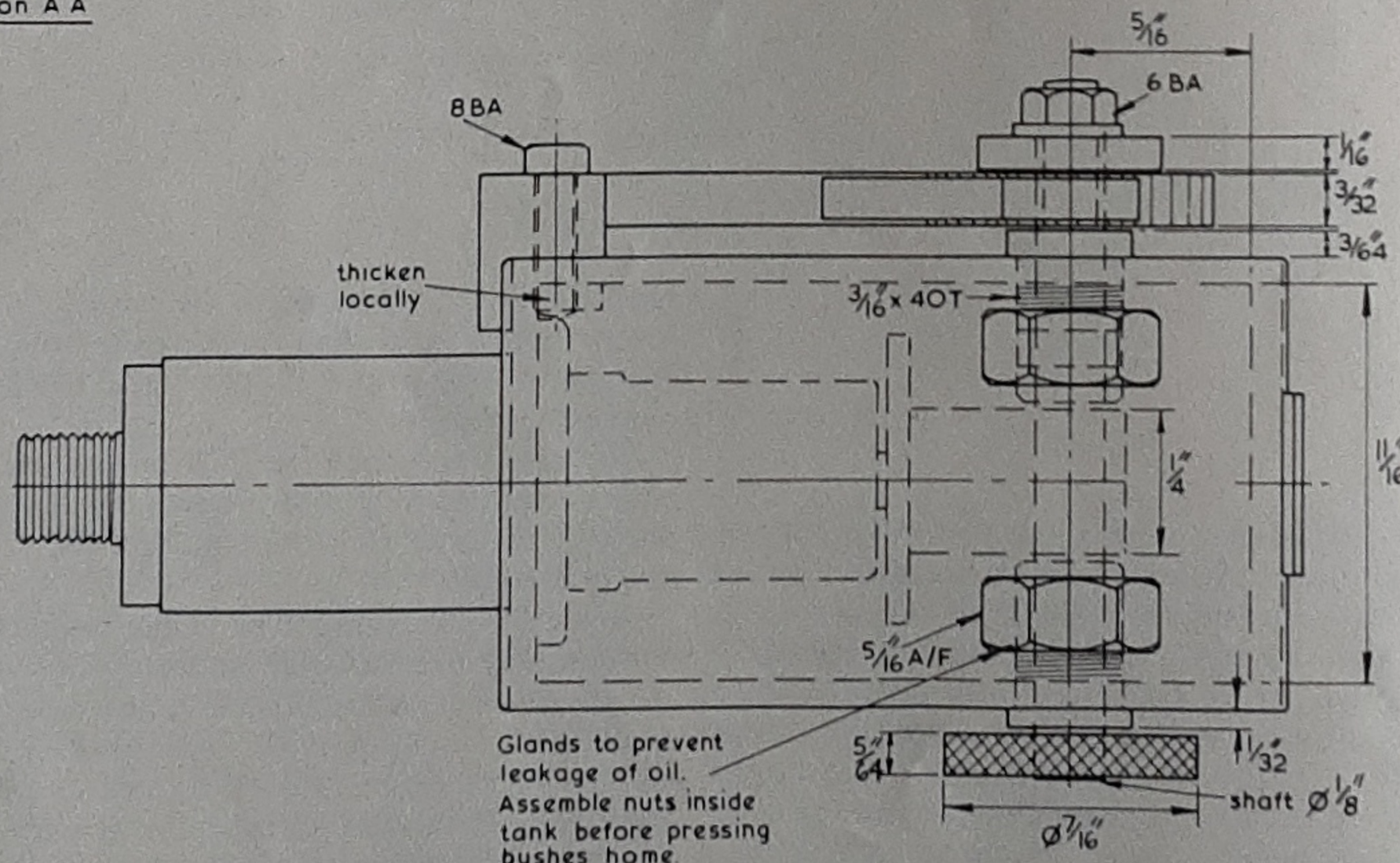


* drill two holes at 45° to vertical from below

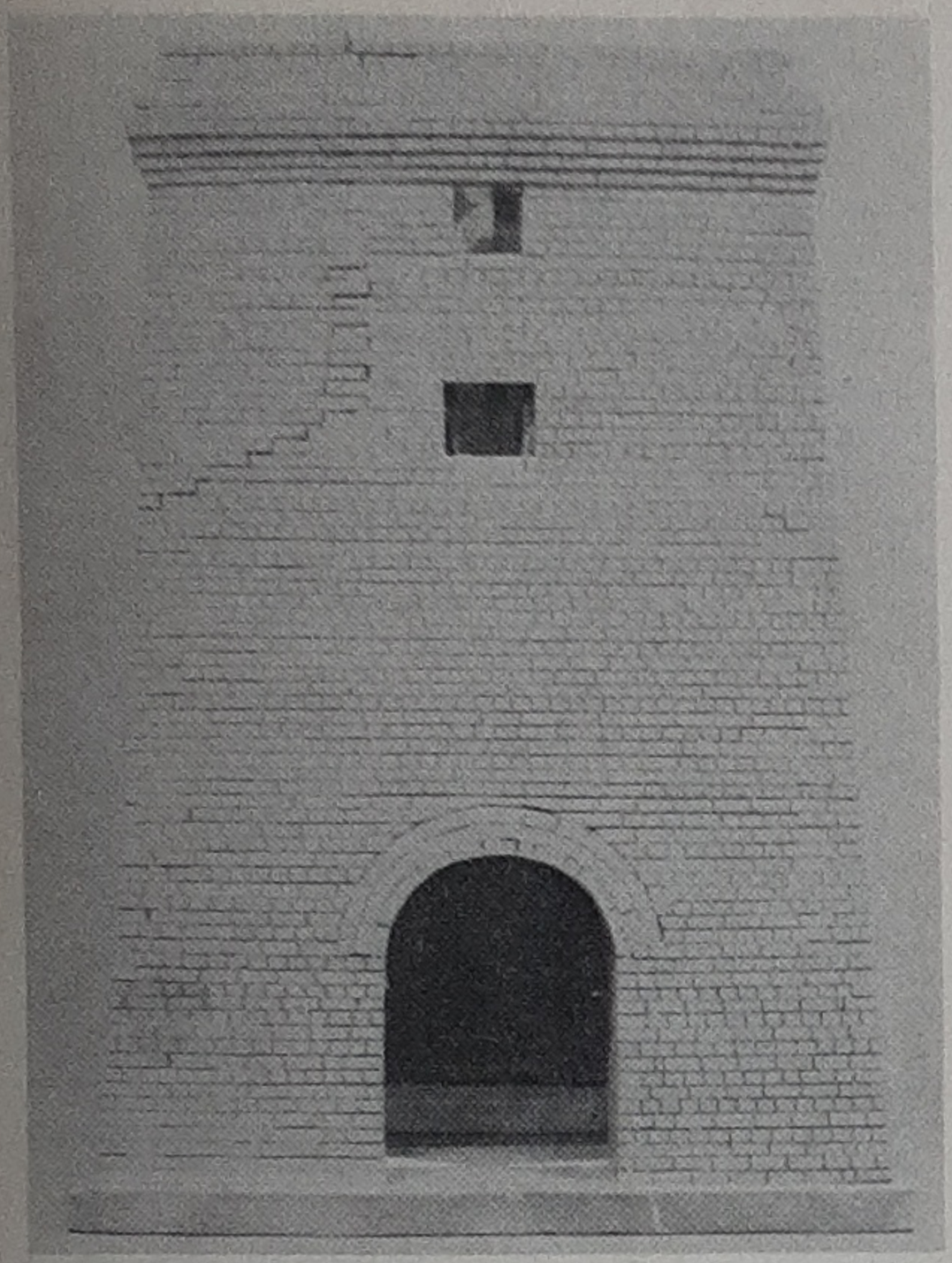
Ram length overall 0·735"



Section A A



MECHANICAL LUBRICATOR (x4)



Model headstock showing removable piece for access to the interior.

HOLMSIDE AND SOUTH MOOR COLLIERY

By Ernie Cheeseman

Part V

From page 649

WHEN THE HOLMSIDE AND SOUTH MOOR Coal Company was formed, taking over the stone buildings of the South Moor and Quaking Houses collieries, the Board obviously decreed that a prolific brick manufactory was an essential part of coal mining. Not only did the company subsequently build the greater part of five villages to house the miners, the brickworks they established at the Charlie Pit gave substance to the surface buildings, and underground brickwork of all their eleven mines.

Realising that the reproduction of scaled brickwork would be the major feature in the building of my model, I gave the matter a great deal of thought, for my ultimate method had not to be too expensive in time, yet still retaining an acceptable degree of authenticity. The method of carving the brick profiles out of sheet wood was soon dismissed. Hand carving gave a much too irregular picture, yet any sort of guide to my tool produced just the opposite; it is surprising how irregular the individual brick courses can be; yet still give a "square" structure.

I actually tried bricklaying in miniature, the tiny bricks being laid in a mortar of "Polyfilla". The result was very pleasing, but the time consumed was too great a price to pay.

The method finally adopted fell midway between the foregoing two, and when I started on the airshaft tower, I had given up any hope of seeing any plan or drawing of it, and had to rely entirely upon memory plus a little technical reasoning. Nearly all the company's buildings used the "facing bond" style of bricklaying (see Fig. 1); however, I reasoned that for a highly stressed "headgear" tower, maximum strength would surely demand something like the "English bond" tie (Fig. 1.D).

As regards the actual tower measurements, well, memory played the largest part. When I had already passed the building point of no return, I was most unexpectedly presented with a photograph of the tower taken in 1966, just before it was demolished. It was most gratifying to find how close my guesswork was.

As implied, my final choice of building material was wood laths, dressed to 3/16 in. thick by 1 in. wide. Using a simple jig, one side of these laths was regularly notched with a junior hacksaw (see Fig. 2). Other materials used were strips of thin cardboard, and loads of glue and small panel pins. Fig. 3 shows in principle, my method of building. There was of course some elementary bonding and tieing of the strips at the corners of the tower.

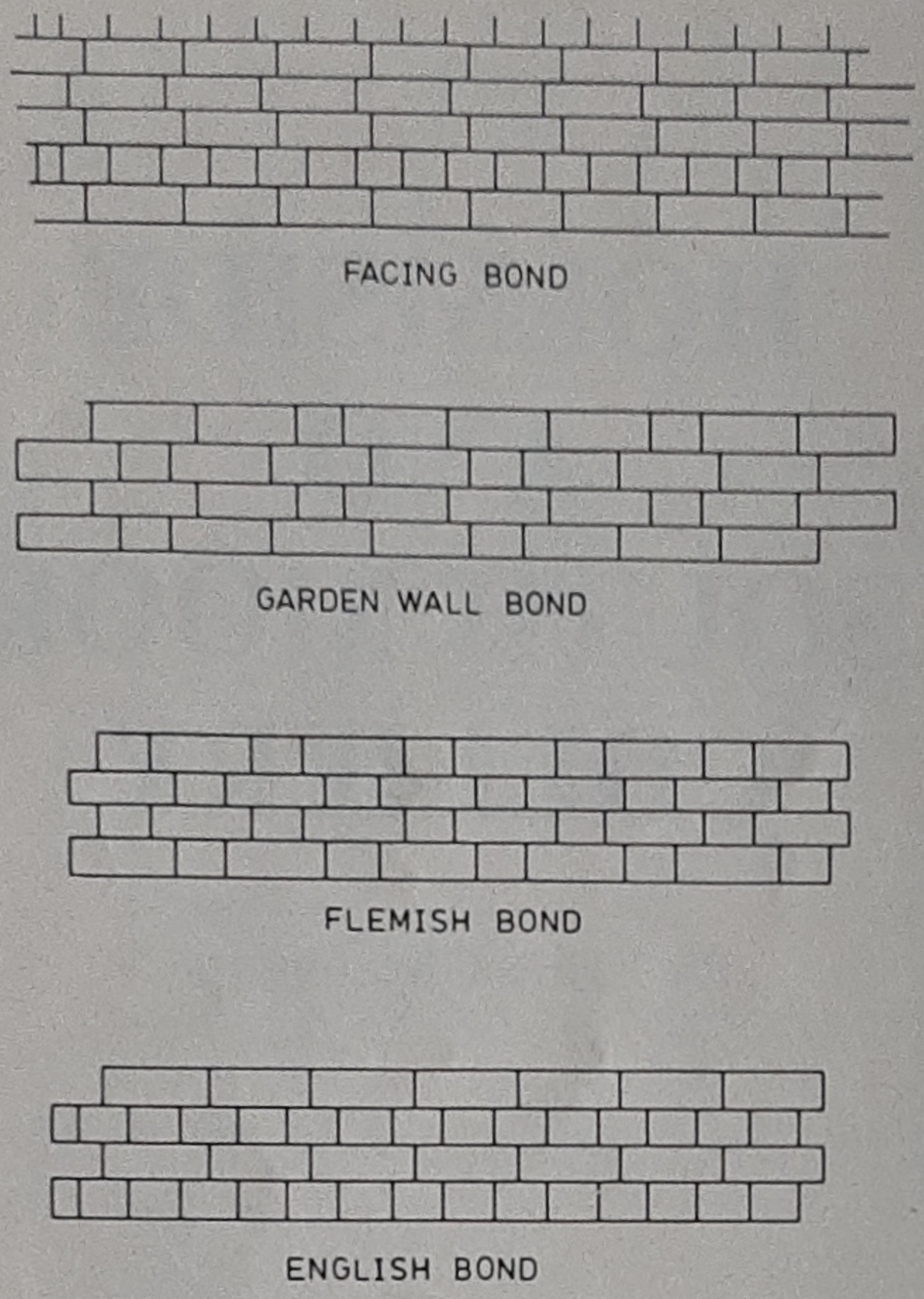


FIG 1

It will be noticed that the saw-cuts, and the gaps made by the cardboard spacers are unusually deep: this was a deliberate policy, to allow the various faces to be drastically sanded to finished texture, without smoothing the gaps out altogether: besides, it will be noticed that the whole tower is tapered on the outside. These four faces were built in a series of steps, so that I could use an ordinary engineer's square to keep me on course; an alarming amount of wood was subsequently sanded off, to reduce these steps to the required continuous taper.

After sanding, the whole job was given a liberal coat of thinnish primer, worked well in. A couple of undercoats preceding the final matt finish: all this was brush worked. The colour of that final coat was the lightest tint one would expect to find in an engineer's brick. The whole lot was then left to dry out thoroughly.

Now comes the "fiddly bit"; I had not realised before how many different colours are to be found in a single brick. I attempted to reproduce these in a sort of random fashion, starting with the lightest and finishing with the darkest: this was followed by a prolonged drying period.

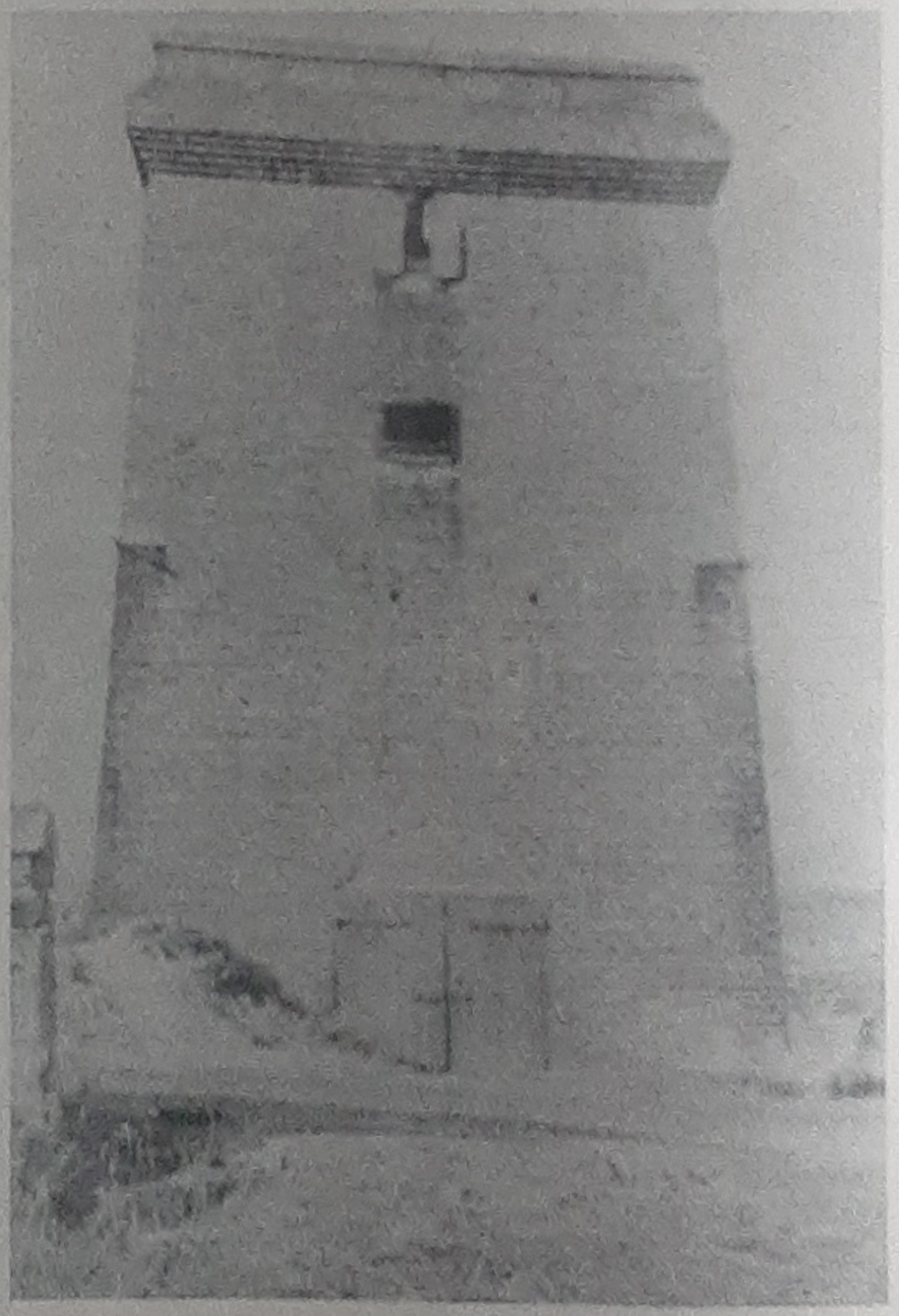
I now had a brick tower which looked in dire need of pointing. This was corrected by working "Polyfilla" into the gaps, and I found it was best to do this with the fingers, as any tools tended to scratch the painted surfaces. Care had to be exercised in removing all traces of "Polyfilla" from the brick faces before it dried out.

When the "Polyfilla" pointing had set, I brought my air-brush paint spray into use; charged with well thinned down "mortar coloured" flat paint, I applied several coats until the required colour of the mortar was achieved. The face of the brickwork was rubbed clean with soft clean rag between each spraying, leaving only the absorbent "Polyfilla" holding the paint.

Finally, using thinned down flat black, the whole tower was sprayed from above only, thus creating an impression of soot, and coal-dust caked ledges.

A word about those arches in the tower; when I had reached the "springing" height of the arches, I used an aluminium sheet bent to the required curvature and fastened to the sides of the arch, instead of the usual building method of using a wooden template; these were not removed until all the arch rings had been laid and set, and the tower brickwork built up three or four courses above the keystone level.

The full size tower just before demolition.



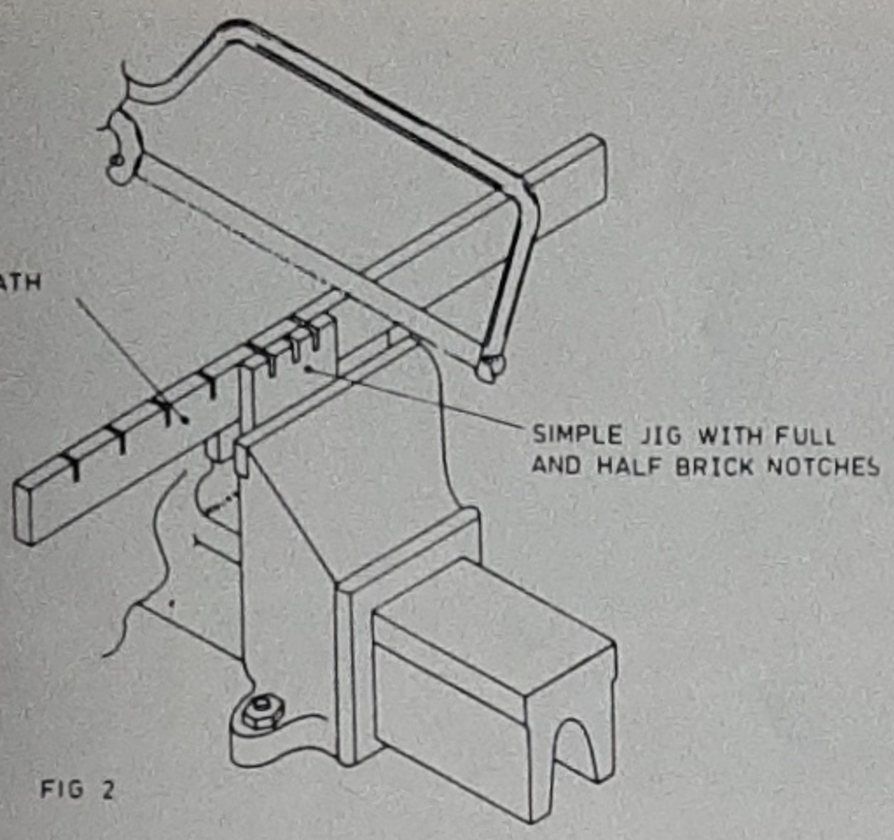


FIG 2

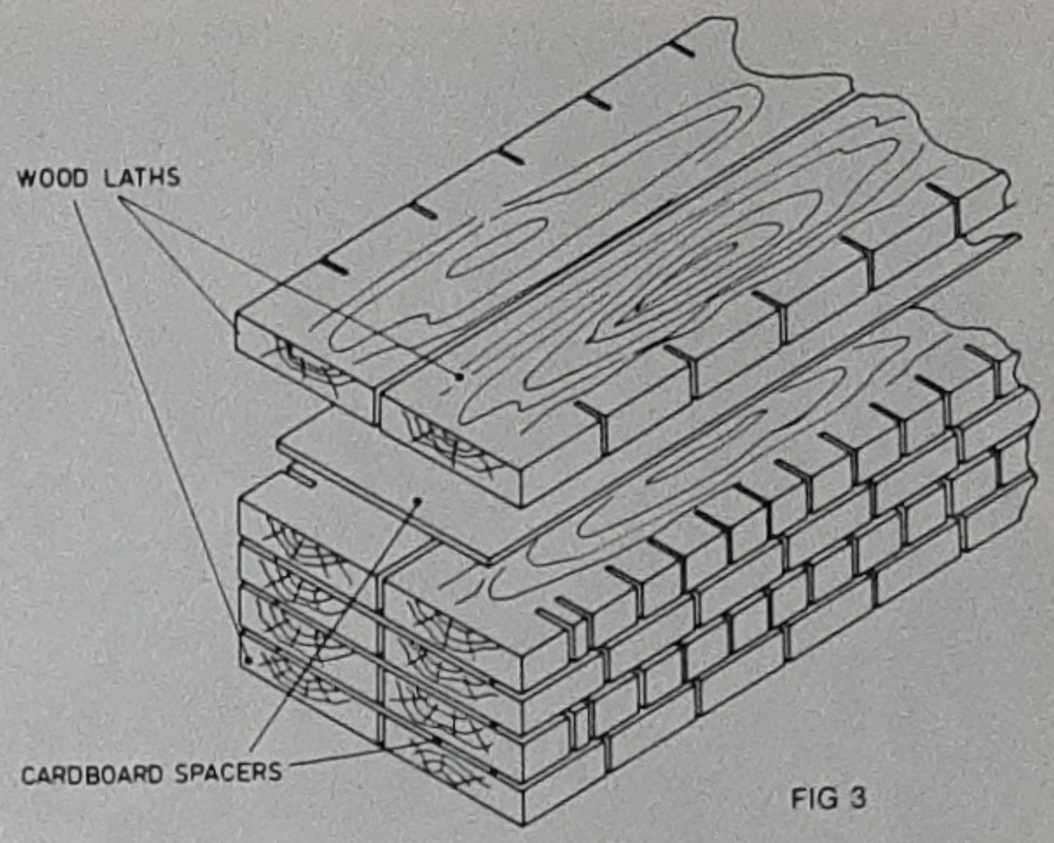


FIG 3

No attempt was made to produce a voussoir form for either springers or ring bricks.

Referring to Fig. 4, No. 1 is the first ring, and is the only ring which was notched on the underside of each wood (strip) course. No. 4 is the cardboard spacer, between the first and second ring; No. 5 is another spacer between second and third ring (No. 3). The two No. 6s are the spacers between the abutment courses, which were made up of the previously mentioned laths (No. 7s). The whole of the tower inside had the same treatment as the outside showing all the courses. I hope to describe the large amount of detail work inside the tower at a later date.

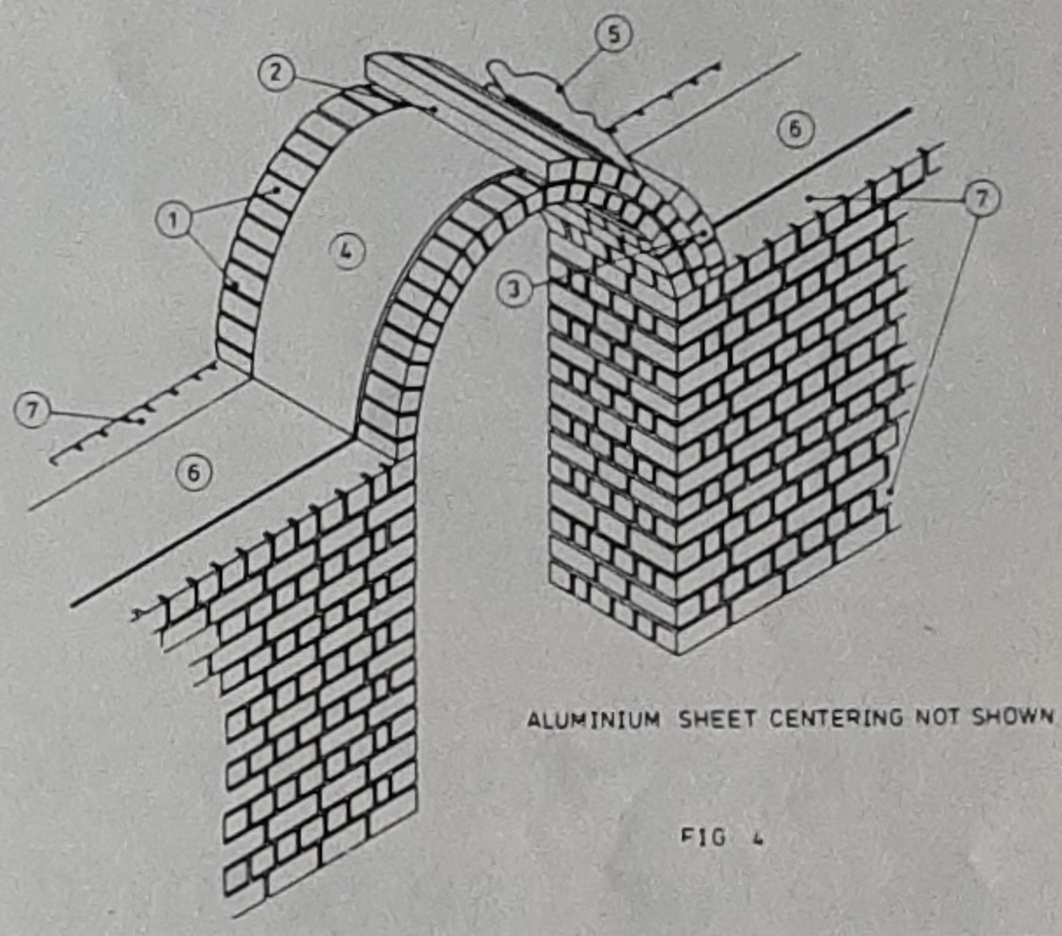
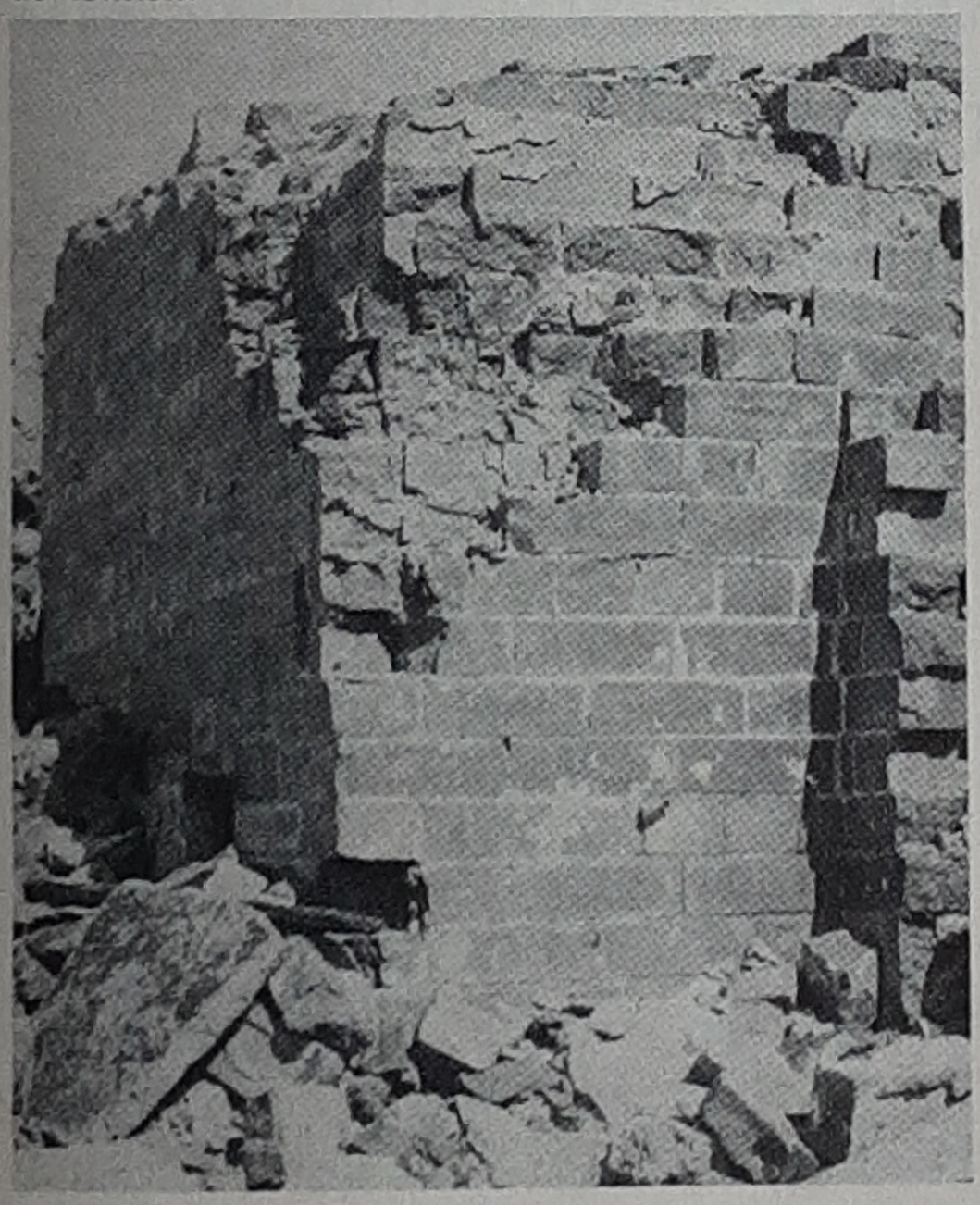
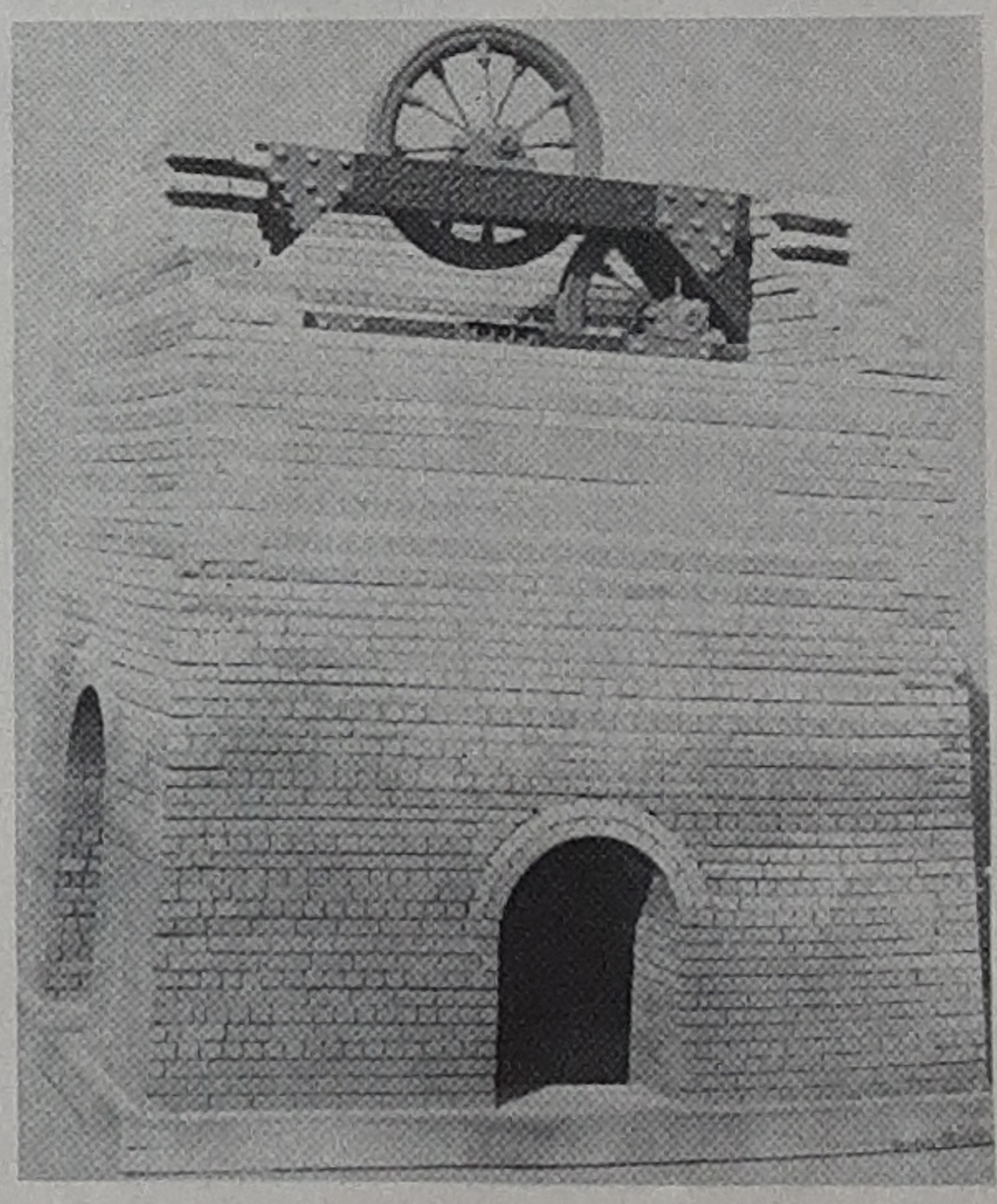
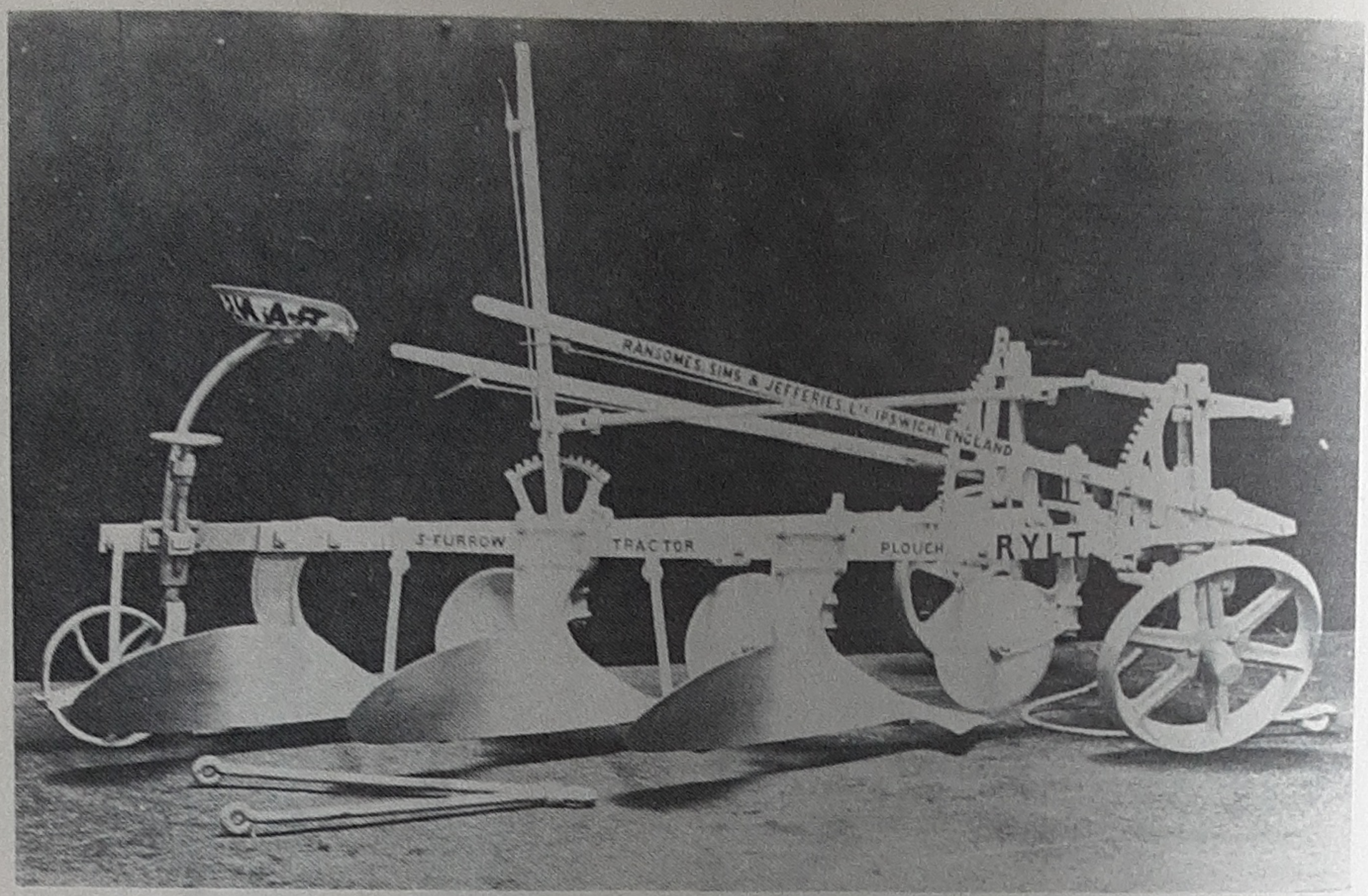


FIG 4

A similar construction from the same company which defied demolition.







Photographs by courtesy of Museum of English Rural Life.

A Three-Furrow Steerage Plough in 2 in. Scale for use behind the Ransomes Steam Tractor

By John Haining

THOSE READERS building the Ransomes 4 n.h.p. compound steam tractor as it was turned out for road work, with rubber tyred wheels, will only be able to use their engines for either straightforward haulage or for drawing machinery by belt from the flywheel, owing to the lack of grip of rubber tyres on grass or soil surfaces.

On the other hand, steel straked and tyred engines can be used with towed implements in the field, and it was with the aim of providing haulage power for several of my two-inch scale implements that this particular light steam tractor was decided upon as the prototype for an engine in that scale. I touched on the early history and development of direct traction ploughing in *M.E.* No. 3476, dated 2 November 1973, but a few background notes here may be of interest to any readers contemplating building suitable tackle to work with their engines.

Following upon the direct traction ploughing trials of 1857 with the Burrell-Boydell heavy haulage traction engine described in the article a number of makers continued to explore the possibilities of the system, with varying degrees of success, the principal trouble encountered being the effect on the soil crumb structure by heavy engines with steel straked wheels — conditions of impaction and "panning" not encountered when using the far more popular cable system of steam cultivation.

From the late '70s or '80s of the last century, traction engine manufacturers in the U.S.A. built a variety of big, powerful engines designed specifically for direct traction ploughing, as many as twenty or more furrows being cut at one time by ploughs "ganged" behind each engine, working over the open flat prairie lands in line abreast. British traction engine builders offered "Colonial"

specification engines for the same purpose overseas, the ploughs used being two- or three-furrow wheeled steerage types, towed by chain, and this type continued to be made up until after World War I, when the U.S.-built petrol/paraffin tractor took over direct traction ploughing from the steam tractor and plough designs commenced to radically alter too.

Up to 1919, the steerage plough, steered by vertical lever moving in a quadrant and controlled by the seated steersman with a simple lever arrangement for raising the plough bodies in or out of the ground, was widely used, but in that year Ransomes, Sims and Jefferies of Ipswich introduced a new design of plough, the RSLD. This had a self-lifting arrangement operated from the tractor driver's seat and so dispensing with the need for steersman on the implement itself and making the unit a one-man outfit.

This innovation in plough design gained immediate popularity, its success being demonstrated by the fact that it gained in its first year no less than four silver medals, one at the Royal Agricultural Society of England Tractor Trials, one at the R.A.S.E. show, and two at other agricultural shows in this country.

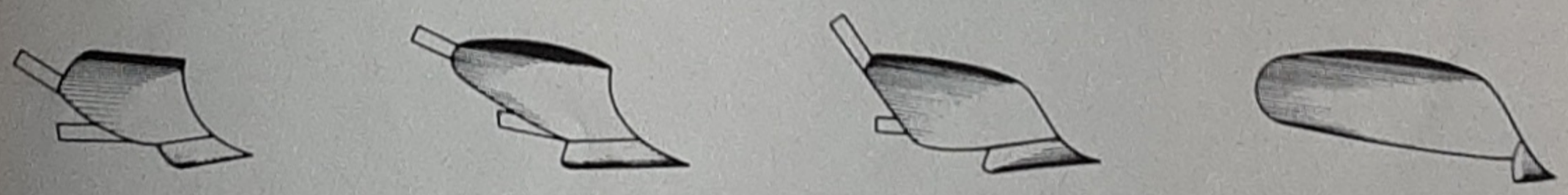
From being a simple implement turned out by individual makers or even village blacksmiths, the plough had become a well-thought-out engineering job, designed on the drawing board, and from this point onwards plough design changed several times as different methods of use became fashionable. The early tractor ploughs had straight beams with skifes attached carrying the bodies, but later in the '20s ploughs with swan neck beams each carrying one body became popular, although a few years later there was a reversion to the straight beam with legs, as the skife was now called. The most important development in the post-World War I history of the plough was the introduction and evolution of the mounted plough directly coupled to a three-point linkage on the tractor, with which layout the name of Harry Ferguson will always be associated.

The great advantages of this layout are the complete elimination of drawbar and wheels necessary with any trailed implement, coupled with the high degree of control afforded to the tractor driver and the ease with which the plough bodies can be lifted clear of the ground at headlands and on the road.

Rear view of 4 N.H.P. Ransomes Steam Tractor hauling a 3-furrow R.Y.L.T. steerage plough. Tractor seat is tipped out of the way.

Even today, among the modern mounted and reversible ploughs it is still possible to see examples of the post-1919 self-lift beam plough or even one of the "Motrac" ploughs *circa* 1928 with swan neck skifes each carrying a body, working behind one of the older tractors, the driver operating the forward facing handles on the plough to lift at each headland. The plough selected as a prototype for a 2 in. scale model is a 1914 Ransomes RYLT three-furrow steerage plough, designed to be chain drawn behind either a steam tractor or one of the early U.S. tractors such as Mogul, Titan or Overtime.

With this type of implement the skifes carrying the plough bodies are adjustable on the beam or frame. The bodies themselves are built up of a mouldboard and share with renewable tip or point at the front. The mouldboard, sometimes called the breast, is that part of the plough which turns over the sod, thus leaving a furrow; the share or sock as it is sometimes named is the main cutting part of a plough, fitted to the leading end of the mouldboard and making the horizontal cut when ploughing. The



PLOUGH BODY TYPES

type of share varies the style of the ploughing and the main plough body types are illustrated in my sketch, the ones on the prototype of the model being either the semi-digger or the general purpose bodies. The semi-digger type has a slightly convex and much shorter mouldboard than the latter and is adaptable for ploughing lea, stubble or after a root crop though from a model-making point of view the longer example of mouldboard is slightly easier to make than the other examples. A steel disc or coulter runs just ahead of the shares, making the vertical cut through the sod while the mouldboard does the turning over, thus forming a furrow and burying weeds etc. under the turnover. Sometimes these steel discs were replaced by a knife type of coulter which performed the same function.

The model follows full-size practice exactly in that the coulters and bodies lower into work and are raised out again by means of the two side levers in quadrants, and the front wheels steer by means of a long vertical lever moved by the steersman in a notched quadrant.

The rear end is supported by an adjustable-for-height trailing wheel and the offside front wheel is inclined at an angle to cover in the furrow — the cause of some embarrassment when the model was left in the hands of a photographer soon after completion as he assumed that it had suffered some damage in transit and had spent a considerable amount of time trying to straighten the angle stub axle to make it match the opposite side!

The ploughman's bottom was supported in a metal pan type seat similar to that used on mowing machines, early tractors, and the big cable balance ploughs; in fact the pattern of seat was fairly standard over a wide range of agricultural implements and was not as uncomfortable as may appear to modern eyes although a certain manufacturer's perforated seat pattern was reputed to induce rather startling physical changes if sat on for too long a period without some form of buffer cushioning! The seat was adjustable for height and a few of the bumps were absorbed by the slight springiness of the mounting arm.

A rigid triangular A frame towbar was included with the plough although the usual method in the field was to tow behind a tractor with a length of chain attached to the offside front towing D shackle to facilitate burring at each headland.

The model is painted "plough blue" with red wheels, the bodies and coulters being left bright unpainted mild steel.

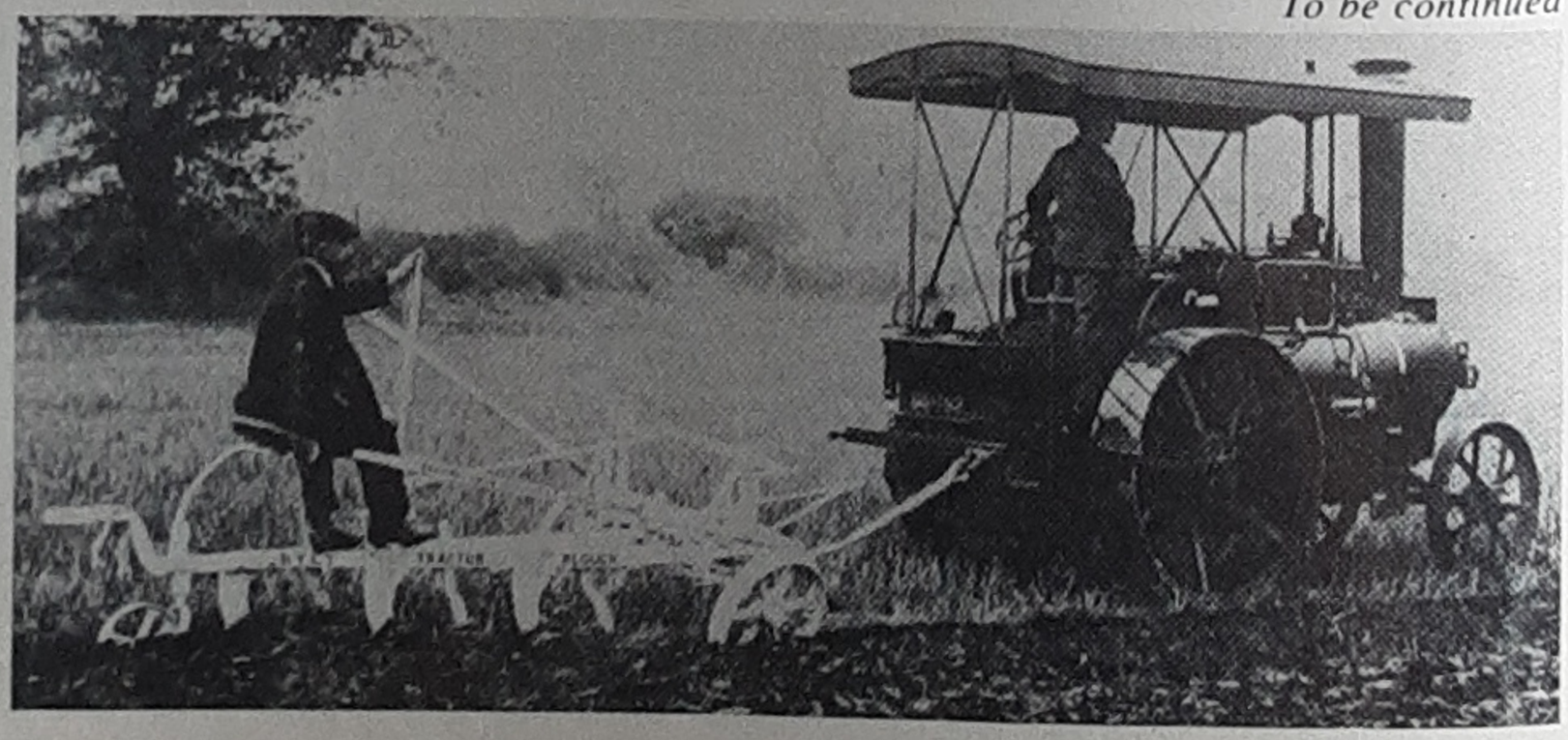
Perhaps I should amplify my remarks about the coulters and bodies raising and lowering into work. This is achieved by the simple expedient of moving each front wheel mounting up or down in guides attached to the front corners of the frame, the beam with bodies and coulters rigidly attached thus sliding up or down by means of the two independent side levers upon the front vertical stub axle bars, some adjustment of the tail wheel height being necessary to compensate for variation in angular movement of the beam from front to rear. Because each side is free to move independently in a vertical plane, allowance is made for angular movement of the track rod connecting the two steering arms.

The three skifes carrying the plough bodies vary slightly, the front two having square palms secured to the beam by a plate and four bolts but differing entirely from the back one which, ending in a narrower rectangular palm, fits between the two side members of the beam where they come together at the tail end. Each skife is formed to mount the three bodies at exactly the angle and an identical distance apart.

The disc coulters, ground to cutting edges, are held on short axle pins in forks, mounted on the lower ends of vertical screwed bars attached to the beam cross member so set that they run just ahead of each point.

A noticeable difference between this plough and the later self-lift and Motrac implements is that the steerage wheels are very robust cast examples with tee or cruciform section spokes, while the post-1919 ploughs had much lighter round-spoked and rather spindly wheels which rather detracted from their appearance in the writer's opinion.

To be continued



Side view of unit. Note the spuds on tractor rear wheels for grip, haulage chains, and spanners on tail of plough. The plough is fitted with knife coulters.

THE PISTON DROP VALVE ENGINE

Part III

by A. Haworth

From page 637

THE INSIDE FACES of cylinders, that is, the side nearest the flywheel in each case, carry the exhaust valve bonnets and the lay shafts and bearing brackets etc. to drive the steam valves. The brackets are secured to the cylinder side by BA studs. The centre line of the lay shaft must be at the level of the centre line of the cylinder bore, that is the centre line of the crankshaft. The steam valve operating lever provides for a maximum valve travel of ⅜ in. and since the lever is of equal ratio, a travel of ⅜ in. must be given by the steam eccentrics. That is not to say that the actual valve will remain open for this amount of travel. The trip gear will release the valve much earlier as a result of governor action.

The brackets attached to the cylinder and supporting the lay shafts are shown as ball bearings. There are two main reasons. Apart from its advantage as a bearing, it is more compact where the space available is at a premium. The bearing and its bracket in fact are integral. I have shown bearings with a bore of 3/16 in. dia., however, since manufacturers are largely producing in metric, some slight modification may be necessary. The outer race should be a medium push fit in its housing and the inner race a medium tight fit on the shaft. In order to increase clearances here it is necessary to choose a ball race with the smallest OD. The lay shaft adjacent to the cylinder is short to facilitate assembly of bearings. A half flanged coupling is fitted at the end and couples to the main lay shaft, the eccentrics are held against shoulders on the shaft and secured by locknuts. This allows retarding or advancing the sheave when setting the valve. The coupling is secured to the shaft by grubscrews. It may be found necessary to groove the cylinder side slightly to clear the eccentric lugs when at full throw.

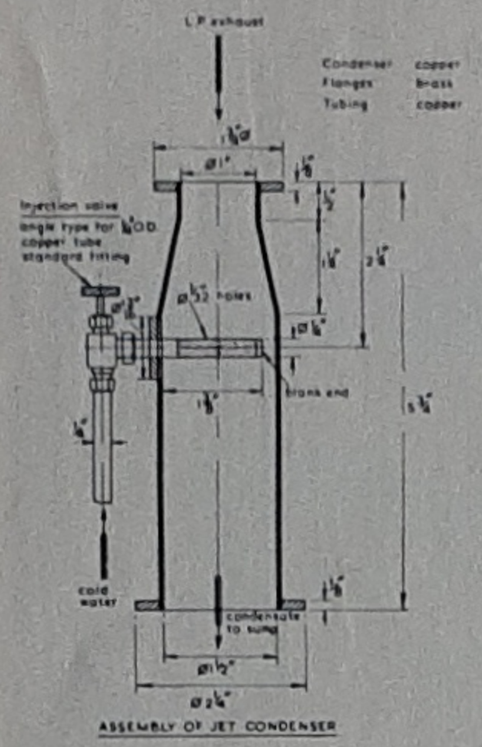
The tail slide and rod.

The main purpose of this in this particular case, is to provide a means of driving the air-pump. In full size practice it also relieves the bottom of the LP cylinder bore of a considerable weight due to the LP piston, and it also performs this function in the model of course, but to a lesser degree. A large full-sized piston may weigh half a ton. The body of the slide may be of cast iron or steel with a tee slot machined along its length, here again it can be argued with some justification that the tail crosshead is not subject to any upward force and a slot in the form of a tee, is unnecessary. It can also be argued that there may be a small upwards component due to the action of the pump side rods. I am in favour of the tee slot on the grounds that the crosshead is prevented from lifting even if it wished to do so. The steel crosshead should be shod with a G.M. shoe plate on its bottom bearing surface and secured with brass BA c/sunk screws.

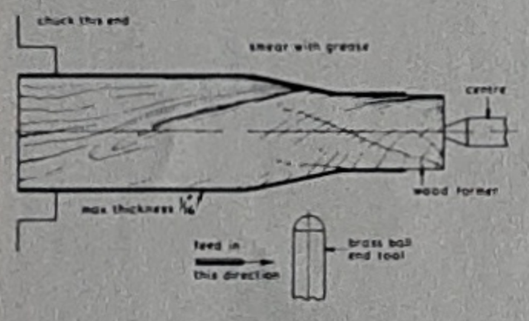
The ends of the slot should be closed with light gauge plate soldered on, but it is essential that clearance be generous at the ends of the stroke otherwise oil will build up and tend to overflow. Adequate oil must be provided. The slide is supported on two steel columns which are themselves supported by an extension of the bedplate. The tail crosshead pin is machined to form part of and is integral with it. This pin receives the side rods which drive the rocking levers, these being pivoted in bearings supported by the bed plate. With an engine stroke of 2½ in. the ratio of leverage of the levers is to give a pump stroke of 1¼ in. The levers are braced at the top end by a tiebolt and the bottom ends carry the side pump rods which drive the pump crosshead. This is guided by circular guide rods, held at the top by the bedplate and at the bottom by lugs at the top of the pump barrel. The detail of rods in this area are small, therefore rod ends are shown with plain bushed eyes.

The pump barrel is of G.M. and is made in two parts. As a whole casting it is difficult to make since the core that forms the annulus is not easy to remove. The two pieces however, can be soft soldered together to form a vacuum tight seal and the temperature is only in the region of 80°F. The angle of core at the bottom of the barrel should be coincident with the cone at the bottom of the bucket. If anything, the angle should diverge slightly towards the circumference. The G.M. bucket is secured to the pump rod of stainless steel.

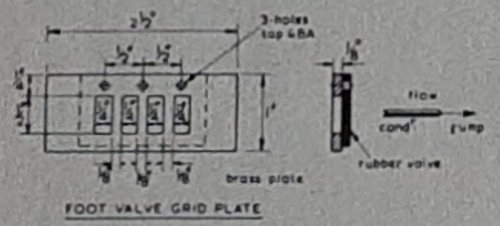
To be continued



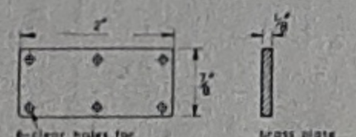
ASSEMBLY OF JET CONDENSER



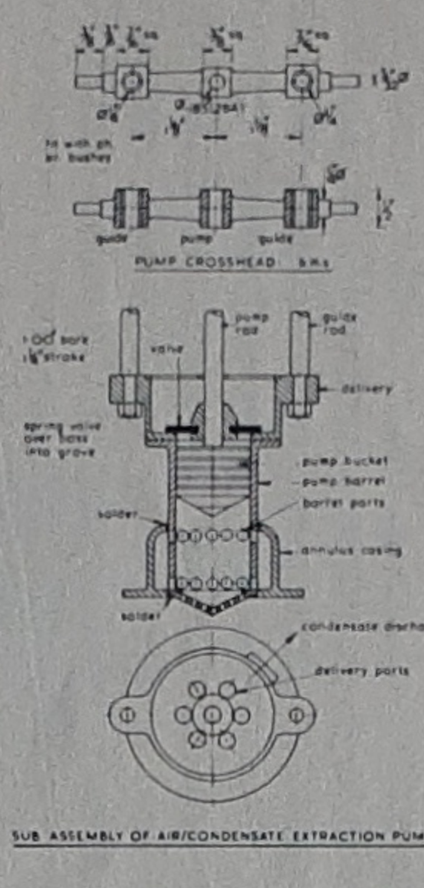
"SWAGING" THE CONDENSER SHELL



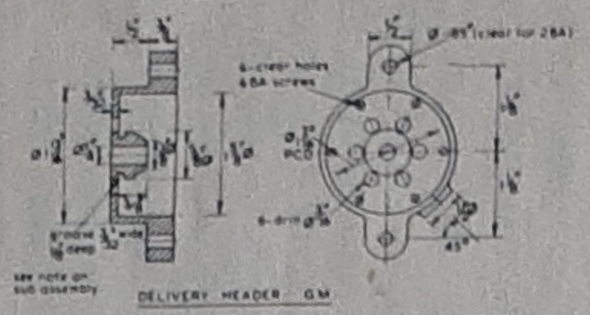
FOOT VALVE GRID PLATE



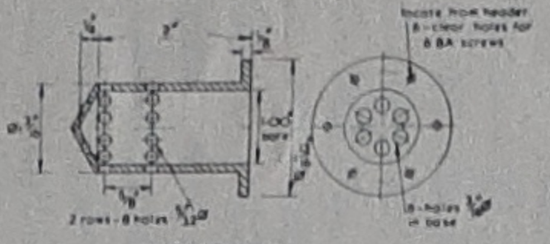
VALVE INSPECTION COVER



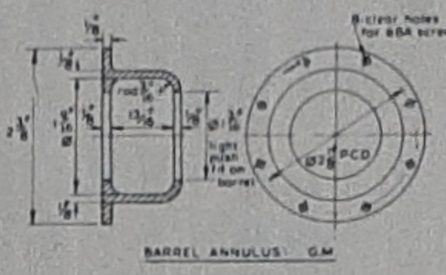
SUB ASSEMBLY OF AIR/CONDENSATE EXTRACTION PUMP



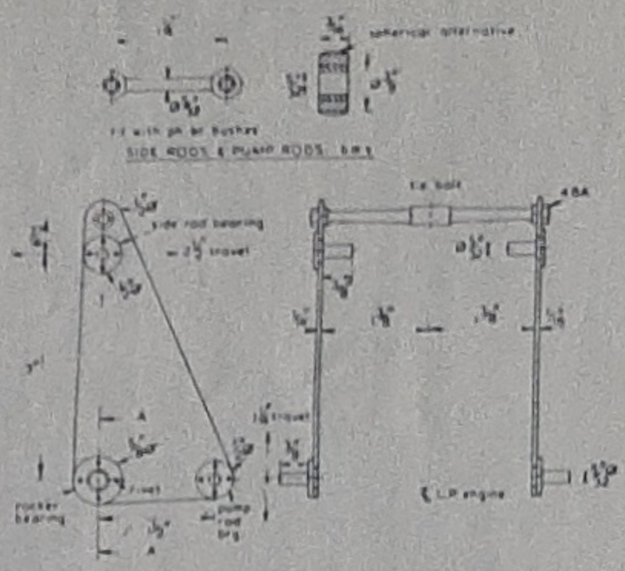
DELIVERY HEADER G.M

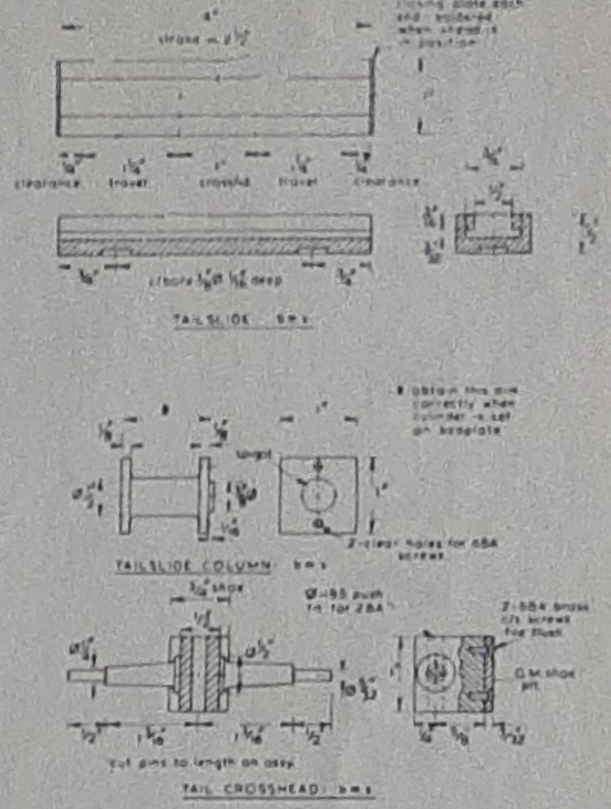


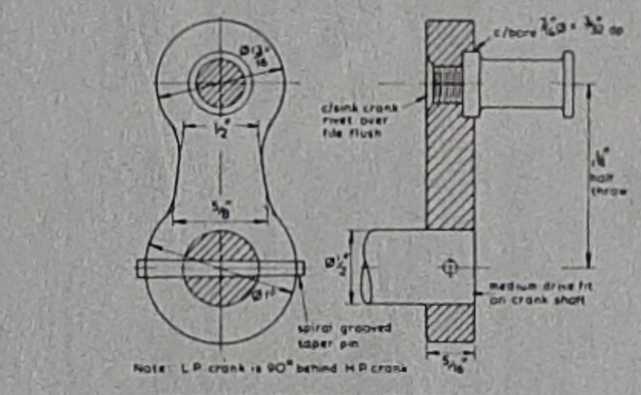
PUMP BARREL G.M



BARREL ANNULUS G.M

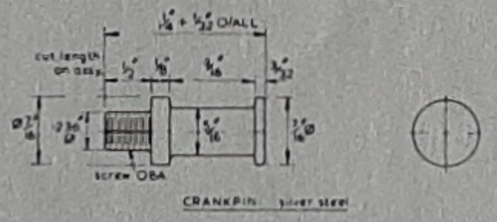




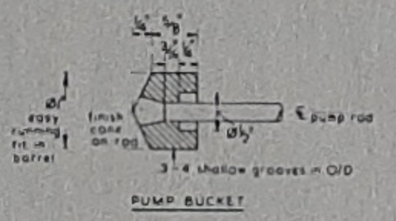


Note: L.P. crank is 90° behind H.P. crank

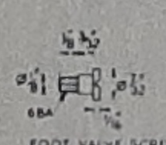
SUB-ASSEMBLY OF CRANK & CRANKPIN brs



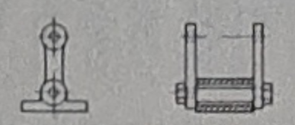
CRANKPIN silver steel



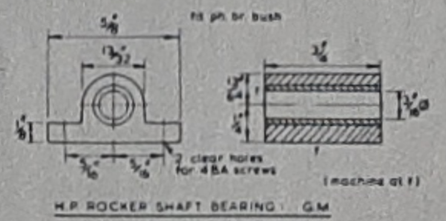
PUMP BUCKET



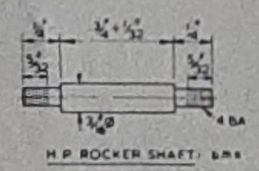
FOOT VALVE SCREW brass



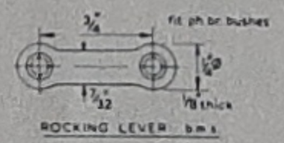
SUB-ASSEMBLY OF H.P. ROCKER SHAFT



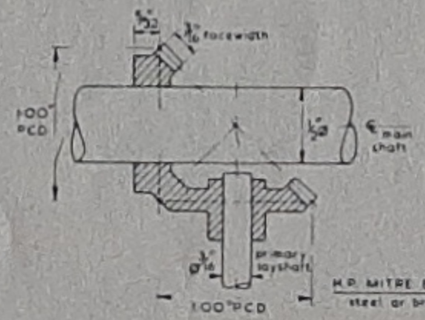
H.P. ROCKER SHAFT BEARING G.M



H.P. ROCKER SHAFT brs

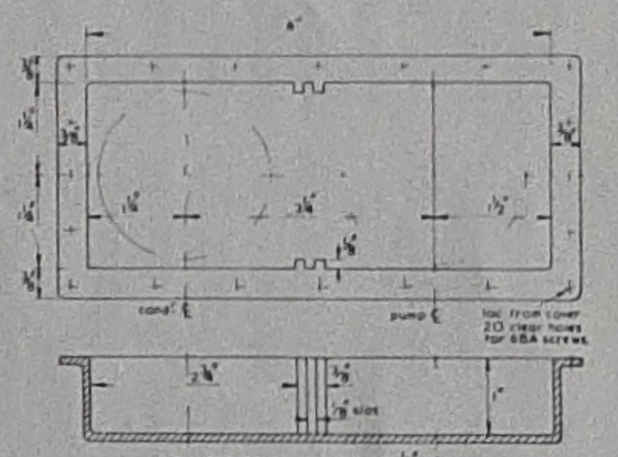


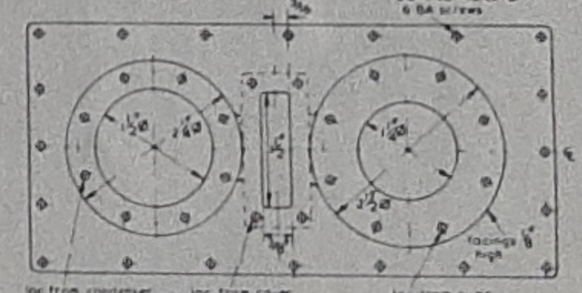
ROCKING LEVER brs

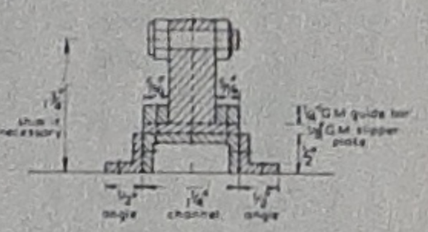


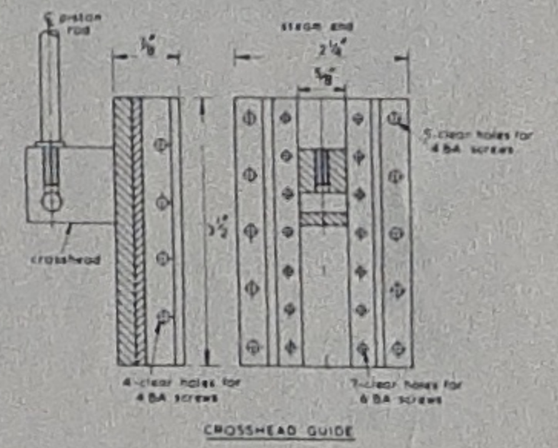
H.P. MITRE BEVEL GEARS steel or brass

Note
Number of teeth & pitch are immaterial providing gears are of equal ratio i.e. one rev. of driver = one rev. of driven. Pitch circle dias. must be as shown

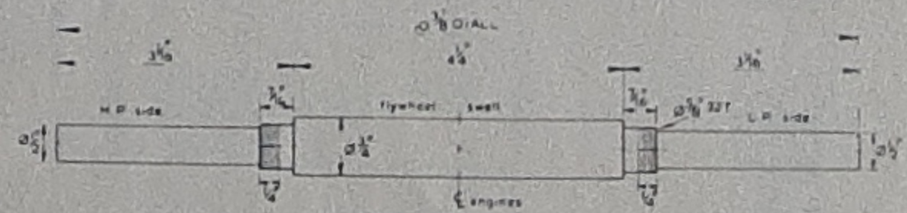



20-clear holes for 6 BA screws
loc from condenser 8-studs 6BA
loc from cover 6-studs 6BA
loc from pump 8-studs 6BA
facings high

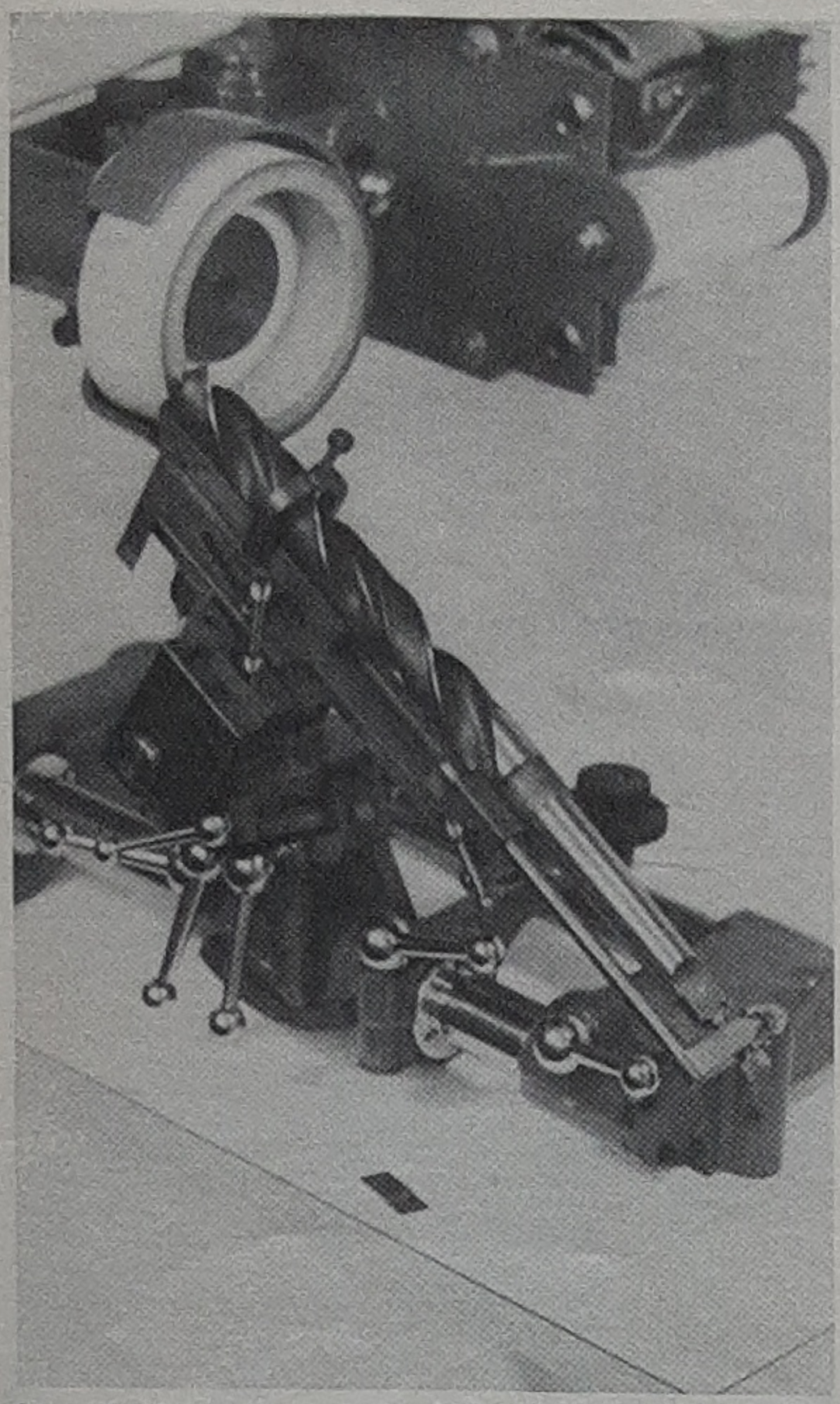




CROSSHEAD GUIDE



ENGINE CRANK & FLYSHAFT brs



Jig with Morse taper shank drill and extended feed screw bracket

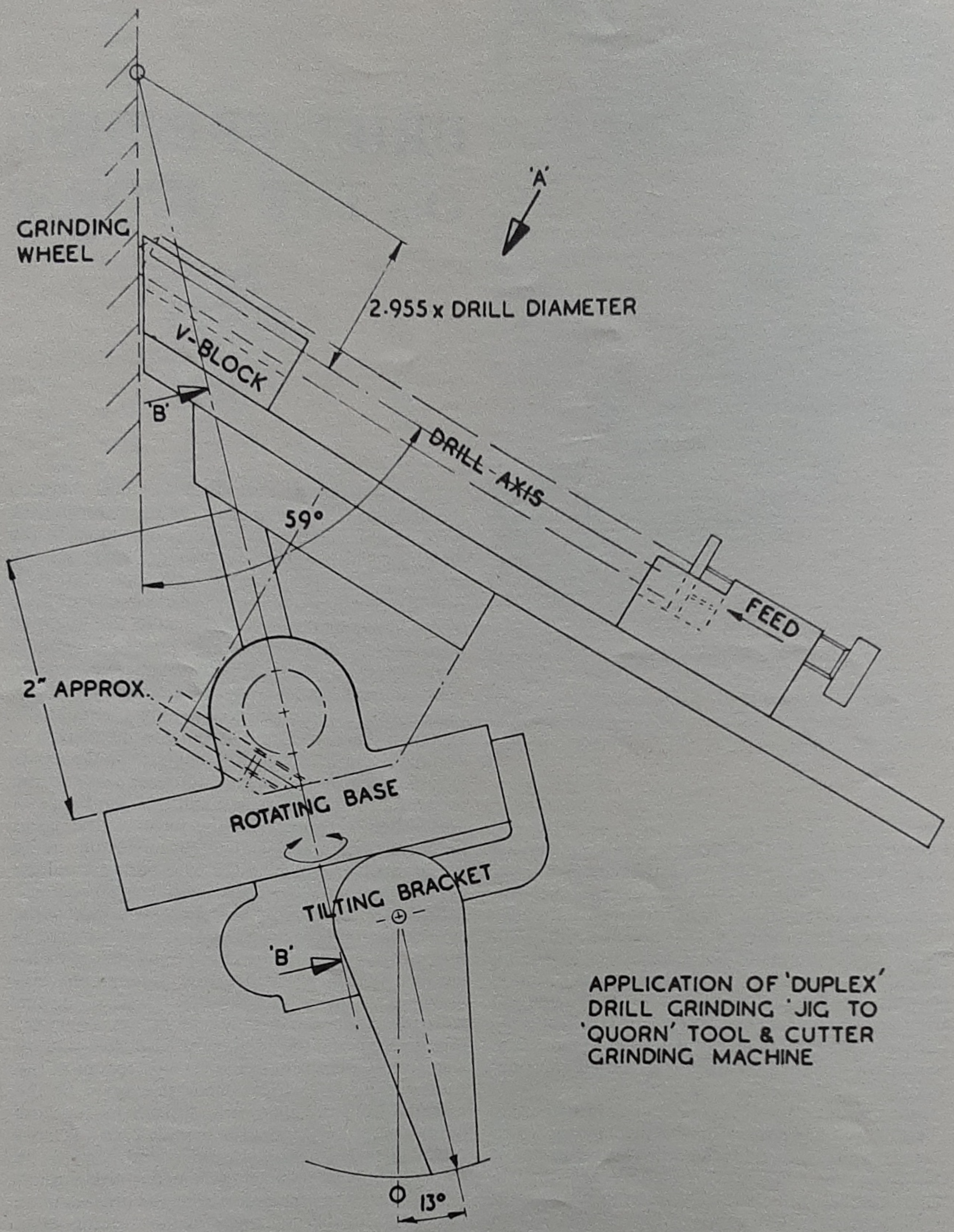
DRILL GRINDING ON THE 'QUORN'

By
I. Strugnell

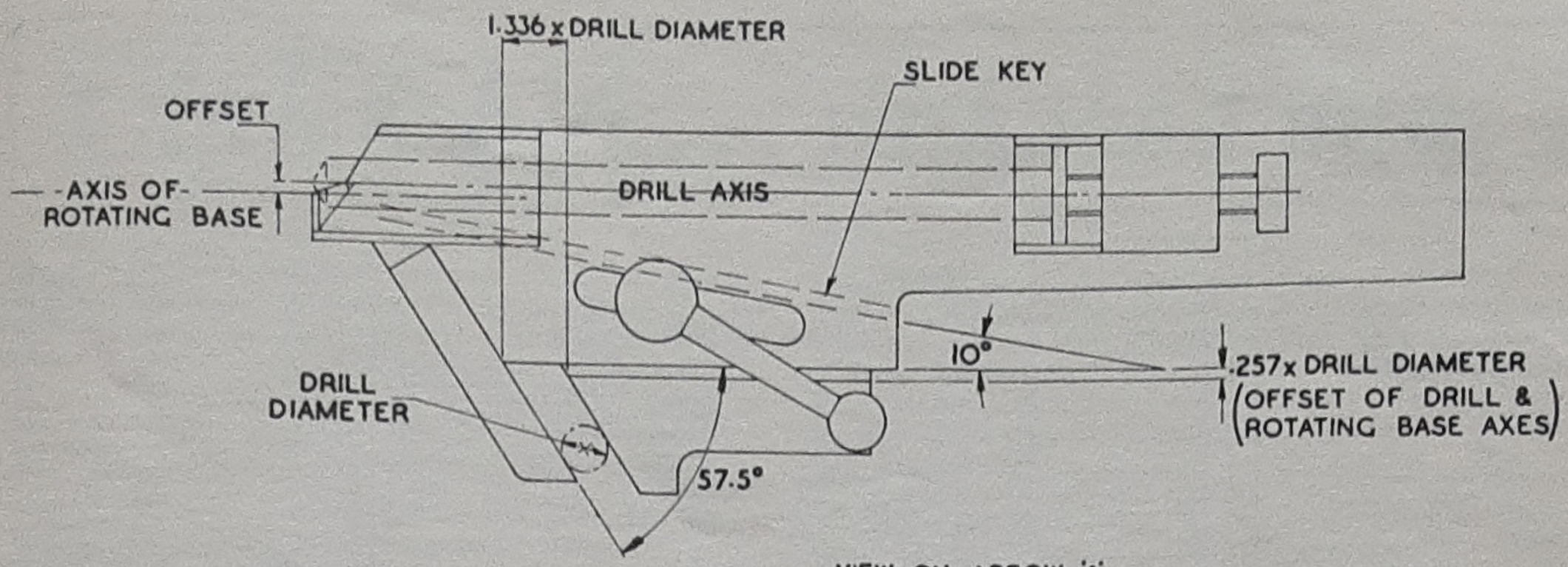
PROFESSOR D. H. CHADDOCK, writing about the tool exhibits at the 1977 Model Engineer Exhibition, suggested that I should describe the drill grinding jig fitted to my "Quorn" tool and cutter grinder exhibited there. At that time the drill grinding jig was incomplete, but I have now reached a stage where I can give a fairly complete description of an attachment which has actually been made and gives practically successful service. It is really the story of the combination of two pieces of workshop equipment designed by highly respected contributors to *Model Engineer,* namely the Professor's "Quorn" and the "Duplex" drill grinding jig. There is nothing original in the mechanism which actually holds and guides the drill, this being almost exactly to the "Duplex" design as published in *M.E.* in 1963-4. I made the V-blocks to accept drills up to ⅞ in. dia. with grooves for clamps, and an additional feed-screw and V-block for the larger drills.

The action of the jig is to form a conical shape on the drill lips, this being achieved by disposing the pivoting axis relative to the drill as shown in the drawings. The lateral off-set provides the necessary clearance behind the cutting edge. Adjustment to suit drill diameter is made by the use of caliper jaws incorporated in the jig, and I made the angle of these slightly different to the "Duplex" figure. I settled on the angle shown after some experiments with different settings and with some help from readers of *M.E.* as a result of writing a letter to the Editor in August 1976. The dimensions shown as decimal multiples of the drill diameter on the drawings derive from this angle and come close to the original specification of the "Duplex" jig. I am still not entirely satisfied with the form of drill point produced, but to adjust the other angles on the jig would involve re-making the base part, so as long as the drills cut satisfactorily I shall leave it as it is.

Professor Chaddock has suggested that some information on how the "Duplex" jig is adapted to fit the "Quorn" might be of use to owners of existing jigs; as can be seen in the photographs and drawings the jig is basically the "Duplex" design with the pivot rod modified to fit the "Quorn" rotating base and the addition of a bracket plate to clamp onto a pin held in the bar bed socket of the rotating base. Because I made the jig to fit the machine from the start, it is difficult to say how easily an existing jig could be modified but it is most probable that a new pivot rod would need to be made, or at least reduced in diameter, also a packing piece may be required to bring the bracket plate into line with the outer face of the rotating base. The jig needs to be mounted so that the clamp screws etc. clear the tilting bracket; the 2 in.



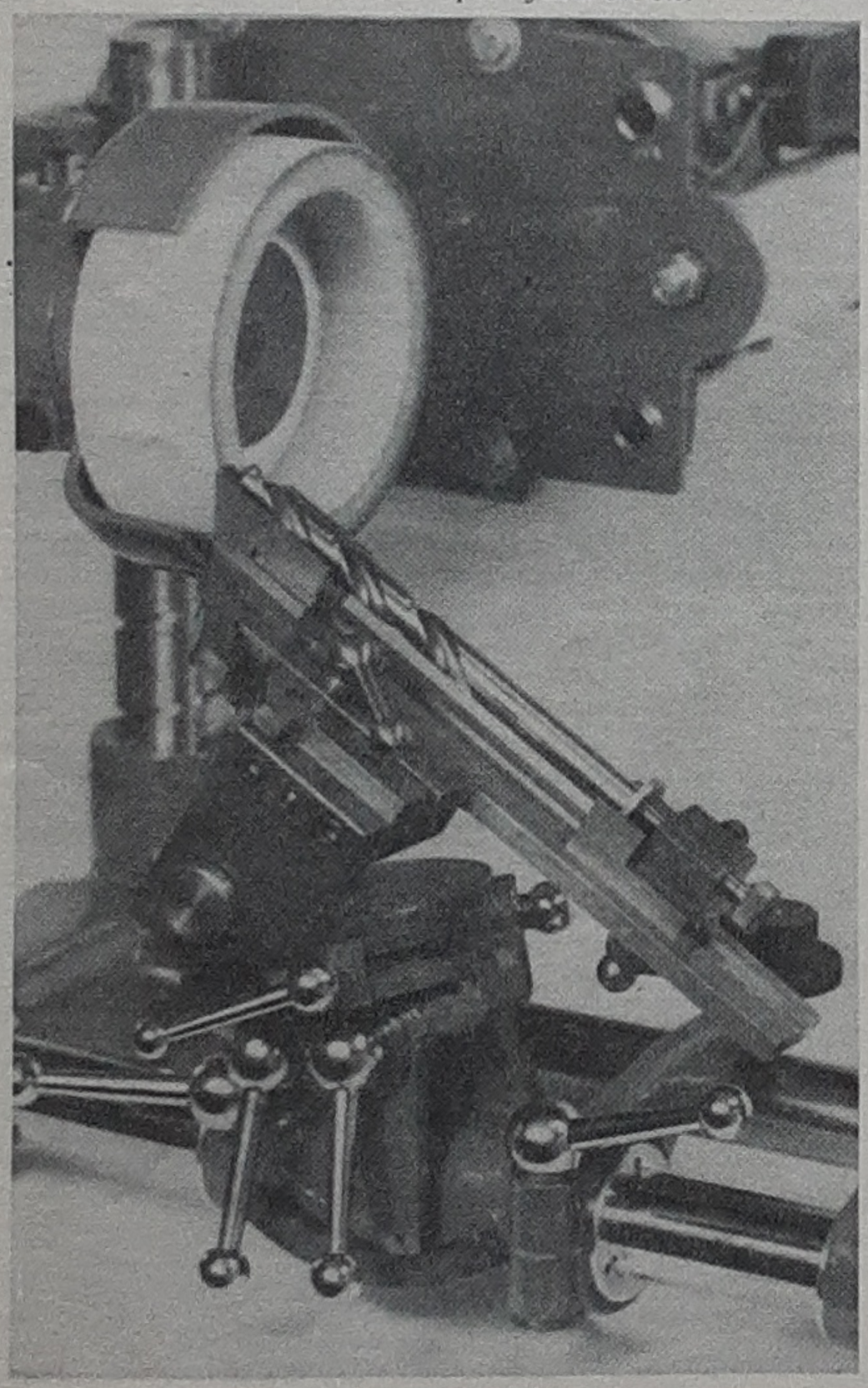
APPLICATION OF 'DUPLEX' DRILL GRINDING JIG TO 'QUORN' TOOL & CUTTER GRINDING MACHINE



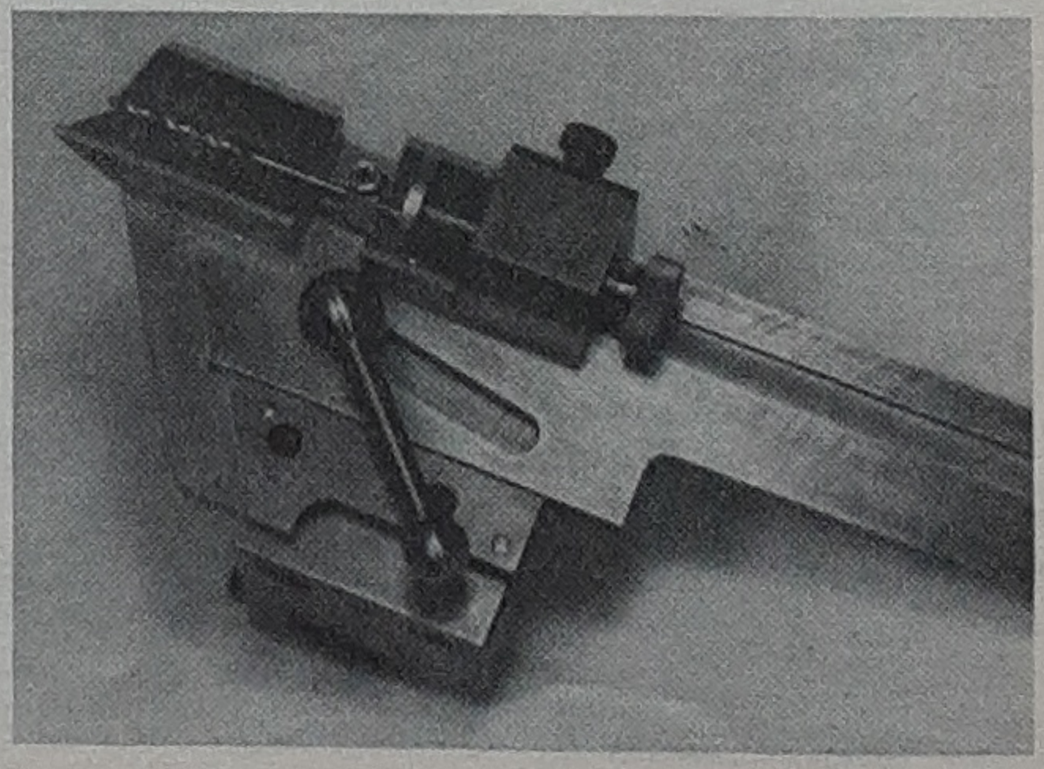
dimension gives adequate clearance on my jig but should be checked. I made the pivot rod so that it sits on a machined face around the setting pin hole in the rotating base; this is not absolutely necessary but it simplifies insertion of the clamp pin. I made the actual location spigot as a separate piece screwed into the end of the pivot rod and turned true to size *in situ*. The short bar bed of the "Quorn" can be used instead of a headed pin to clamp onto, and it helps if the grub screw in the rotating base is moved to one side as shown in the "exploded" sketch. The underside of the bracket plate must clear the stops on the rotating base and tilting bracket, and the plate itself should be firmly attached and located to the base plate of the jig as it is the main means of support. I have not given dimensions for the spigot or bracket plate as these must be made to suit individual machines and the space available.

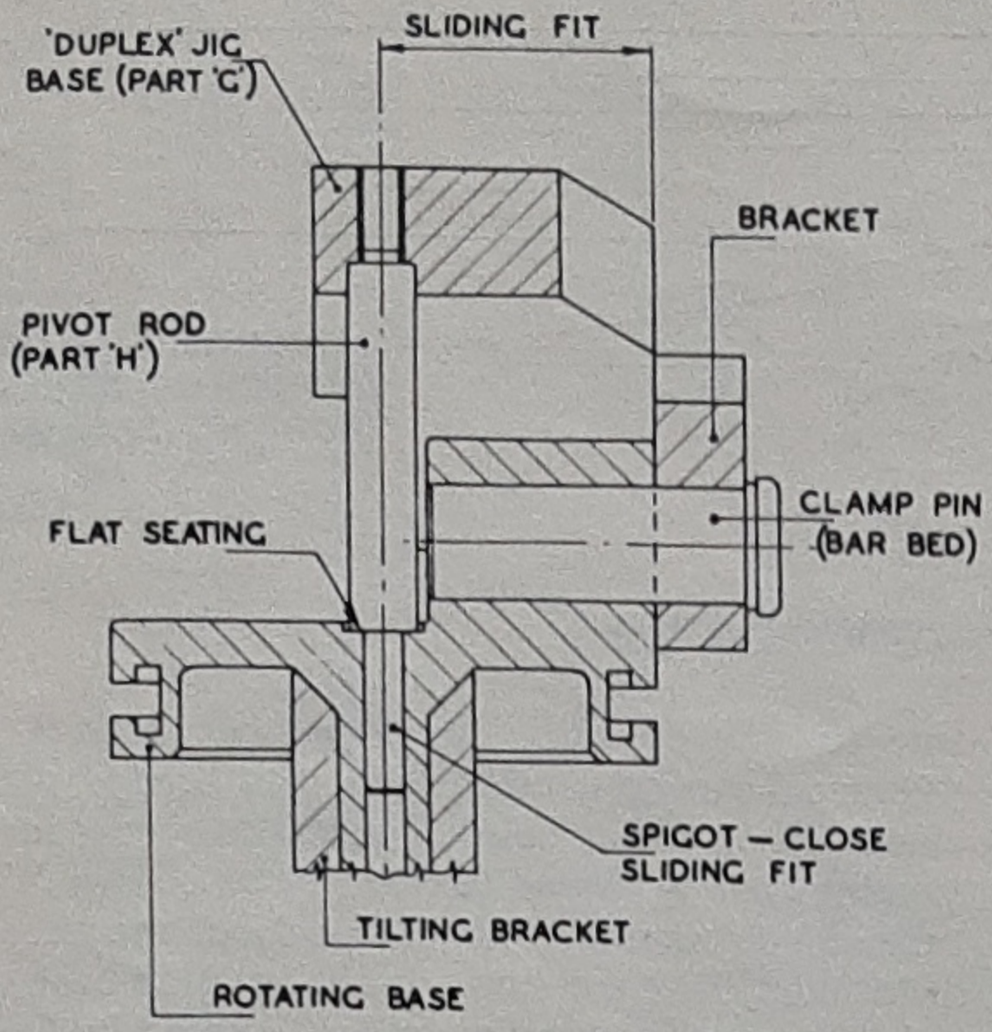
The "Quorn" is used to provide the rotating motion for grinding the point, via the rotating base of the workhead, the tilting bracket being set as shown to 13°. Initial setting, after adjusting the caliper jaws, is simply a matter of bringing the front of the V-block up to the grinding wheel with a .010 in. feeler interposed. Feed for grinding is by the screw and pad on the jig itself, although the micrometer on the "Quorn" is useful if the drill is badly off-centre before grinding — having ground one lip, the feed on the jig is locked and the other lip ground by moving the whole jig with the front bar to the same setting as before. The stops on the rotating

Jig with medium drill and Duplex feed block.

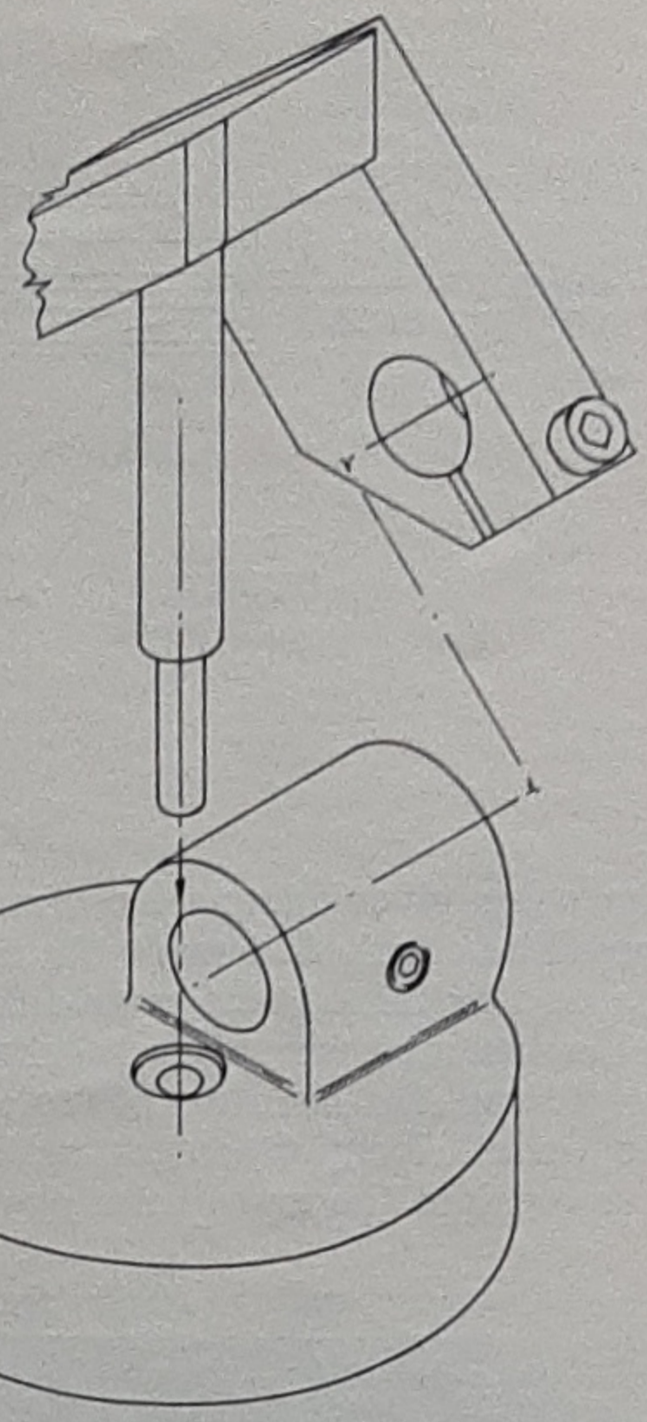


Aligning and holding small drills.

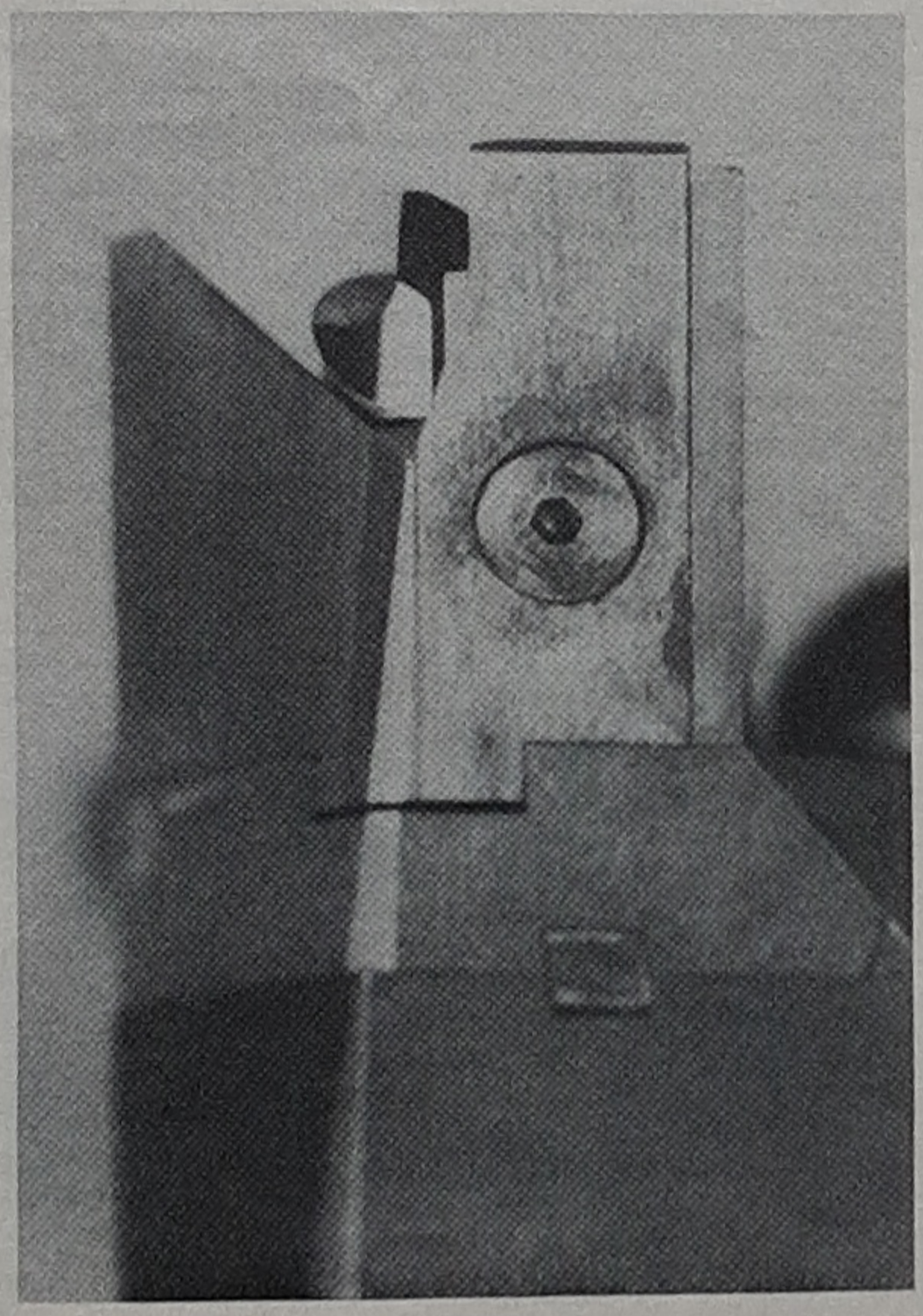




SECTION ON 'B'-'B'



Lip guide on front V block.



base are set to allow a swing of 30°-45° depending on the size of drill being ground. The whole work-head and jig can be swung aside with the front bar to allow removal of the drill without stopping the wheel. None of the other movements provided on the "Quorn" are used, so really a complicated piece of machinery is used to perform a relatively simple operation.

That just about covers the principle and use of the jig, so a few words are necessary on actual construction. This is fairly straightforward, all the machining can be done on the lathe with the aid of a vertical slide. The only hardened parts are the caliper jaws, drill lip guide on the front V-block and feed-screw pads. I ground the angle face of the fixed caliper jaw using the "Quorn" and then copied this angle to machine the seating for the moving jaw. Aligning the hole in the bracket which clamps the jig to the bar in the rotating base was a bit tricky. I fitted the angled rod which locates in the centre of the rotating base to the base plate of the jig, then took measurements of its position relative to various faces and made the bracket to corresponding dimensions. I had to adjust the position by about .005 in. on assembly, which I considered to be as much luck as judgment! Ball handles to clamp various parts are in proportion to those on the "Quorn" and made in the same way. The whole jig lives in a wooden box when not in use (most of the time), which with some V.P.I. paper inside should keep the rust at bay.

Club Chat . . . with the Editor

Since I asked for a few more details about the **North Wilts. M.E.S.** a few issues back, I have received a letter from the new secretary, Mr. David Bound, who lives at 43 Keats Close, Wootton Bassett, Swindon, Wilts. SN4 8HH. The Society's club nights are the first and third Friday of every month and the venue is the Rodbourne Road Working Men's Club, Rodbourne Road, Swindon. There is a 5 in. ground level track at Coate Water Park, Swindon and an extension is planned later this year. During the summer every fine Sunday afternoon is devoted to public running and visitors have the chance of seeing a G.W.R. 38xx, "The Great Bear", "Firefly", "Speedy", "Maid of Kent" "Butch" and the club loco, "Pansy". Several more are under construction and David tells us that the club is now building a "Nigel Gresley".

The **Furness Model Railway Club's** Easter Exhibition at Barrow-in-Furness appears to have gone well and the latest *Turntable* includes a report by "Julian". The E. N. Davidson Memorial Trophy was won by Mr. R. Reeves of West Cumbria Guild with a 1 in. scale "Minnie" and this was well-deserved. Also impressive were a vertical boiler by Mr. T. Jones in the model engineering section, and the sailing ships of the Barrow Ship Model Society. The Highly Commended 1⅛ in. scale Victorian steam launch "Branksome" by D. J. Jacques was "a joy to see". She is powered by a Stuart Turner double 10 V. "Julian", like many others, missed the Showman's Locomotive and Fairground Organ of Dudley Wright, models which have graced this annual event on previous occasions. They were bequeathed to Jimmy Wedge who was unfortunately taken ill just prior to the exhibition and was unable to complete the rewiring necessary. Better luck next year. The secretary here is Fred L. Firth who lives at 40 Norfolk Street, Barrow-in-Furness. Telephone number is 21192.

Down at **Brighton & Hove Society of Miniature Locomotive Engineers,** the AGM was scheduled for 16 June. It is too early from our position to report on any changes in officers but we will notify you as soon as possible. They have had a hectic Spring Bank Holiday by all accounts with the Exhibition at the New Brighton Centre and, of course, the running at Hove Park. We recorded the sad loss of Jim Hughes earlier but this club has also suffered another blow in the death of Wally Dunstall on 19 April. Wally's "Hielan Lassie" was a familiar sight at Hove Park.

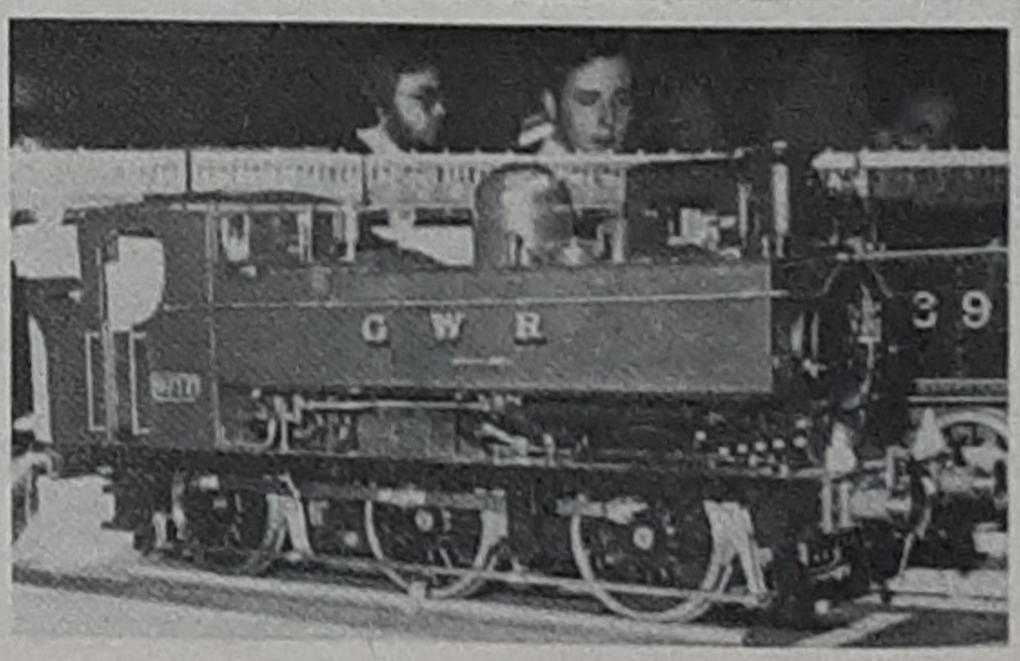
The **Steam Locomotive Society of Victoria** held their AGM on 17 February and as a result the officers are as follows: President, Gordon Schulz; Vice-Presidents, Les Phillips and Ian Davies; Secretary, Ken Tinkler (P.O. Box 115, Moorabbin 3189 — Tel. 95.1171); Assistant Secretary, Alex Rands. Les Phillips tells us that expenditure proposed for their new ground level track will be in the region of $2000 which will cover steel, sleeper material, embankment material and cement etc. The track is all pegged out and the club is requiring the usual labour force to complete the job. I don't think anyone would disagree with Les's description of the advantages of a ground level track.

The *Call Boy*, newsheet of **Golden Gate Live Steamers Inc.,** includes a list of all the Spring and Fall Meets this year. The first have now passed but for our American readers and those intending to be there around that time, here they are: Golden Gate Live Steamers, 16/17 September; Los Angeles Live Steamers, 7/8 October; Chula Vista Live Steamers, 2/3/4 September; Riverside Live Steamers, 23/24 September. The Goleta Valley Railroad Club has planned their Annual Run for 7/8/9 July. Some of these clubs we don't seem to hear much of and if any of the secretaries would care to drop us a line occasionally we will endeavour to keep all club members up-to-date with latest events.

Still doing a bit of globe trotting, we come to Rhodesia where the **Salisbury S.M.E.** has just had its extended track opened by the Mayor of Salisbury to give them one of the longest and most interesting tracks in Southern Africa. We have just heard from Cyril Haden, the chairman of the club who was recently in the U.K. but was, regretfully, too overloaded schedule-wise to pay us a visit. Mr. Haden has sent an article and photographs of the track extension and the locos which will be seen on it. We will publish these shortly.

By the time this issue comes out **IMLEC** will be upon us and we will be hoping for weather like the Spring Bank Holiday. The list of entries is impressive and our only regret is that one or two clubs have had to be disappointed through being a bit late in applying. The interest in this event — and it can be seen in the local trials which take place all over the world — almost justifies a two-day allocation with more competitors, but then one finds the problems of accommodation. This is just a personal thought as I really dislike turning away good club entries, but I would like to hear the views from secretaries. After all there are events lasting over two days — **Guildford's** Exhibition and Rally on 15/16 July is a good example — and doubtless there are many hardy creatures prepared to set up camp overnight if the facilities are made available.

Two photos from Jim Ewins; Top: Robert Mundy's 1978 M.E. Exhibition "Pansy". Bottom: Walter Skuse's LBSC Memorial trophy winner — also a "Pansy".



CLUB DIARY

Dates should be sent at least five weeks before the event to ensure publication. Please state venue and time. While every care is taken, we cannot accept responsibility for errors.

JULY

7 Rochdale Soc. MEE. Springfield Park. General meeting.
7 Romford M.E. Club. Competition night.
7 The Model Engineers' Society N.I. Monthly meeting. 7.30 Cregagh Library, Cregagh Road, Belfast.
7-8-9 Southampton & District S.M.E. Southampton Show.
8 Wirral M.E.S. Barbeque 7 Social Evening at the Track.
8 Birmingham S.M.E. Big-Band Bar,B.q. 7 p.m.
8-9 Papplewick Pumping Station, Longdale Lane, Ravenshead, Notts. Open day.
9 Huddersfield Soc. of Model Eng. Scale Ship weekend.

TENTH INTERNATIONAL MODEL LOCOMOTIVE EFFICIENCY COMPETITION

Stoke Park, London Road
Guildford, Surrey

On Sunday
9 JULY

Commencing at 0900

Tickets now available from Model Engineer

9 S.F.M.E.S. Cambridge & District Soc. General M.E. rally (traction engines, boats, locos, etc.).
9 Bracknell Railway Society. Public running.
9 Guildford M.E.S. I.M.L.E.C. at H.Q. Stoke Park.
9 Malden & District M.E. Malden Soc. family day with members' trials on both ground and raised tracks starting 10.15 a.m. Members only.
9 Cambridge & District M.E.S. General model engineers fully welcome to all traction engines, boats, stationary engines and anything. 10.30 a.m. refreshments. Fullbrooke Road, Cambridge.
9 Romney Marsh M.E.S. Portable track at sheep dog trials, Brenzett 2 p.m.
9 Huddersfield S.M.E. Scale ship day. Open to anyone in England.
10 Wirral M.E.S. Track Night. Hill Bark, Royden Park, Frankby, Wirral.
10 Bedford M.E.S. Bits and pieces.
10 King's Lynn & District S.M.E. Monthly meeting. St. James' School, London Road, King's Lynn. 7.45 p.m.
11 Romney Marsh M.E.S. Visit to Drummond Randall's garden railway at Birchley House, Biddenden. 7.30 p.m.
11 Milton Keynes M.S. Bring and buy sale. Royal Engineer, Stratford Road, Wolverton, M.K. 8 p.m.
11 Guildford M.E.S. Ev. comm. meeting.
12 Norwich & District S.M.E. Meeting at The Assembly House. 7.30 p.m. Fred Stone to give a talk about his model engineering experiences.
12 Tyneside S.M.E.E. Bits and pieces evening at H.Q. 7.30 p.m. (Display and chat on members' work.)
12 Bristol S.M.E.E. Time for chatter. A talk with slides on rebuilding a lathe by John Campbell at the British Rail Staff Association Club. The Incline, Temple Meads Station, 7.30 p.m.
12 Harrow & Wembley S.M.E. Track meeting. Roxbourne Park track 7 p.m.
13 S.T.C. (Paignton) M.E.S. Meeting to be held at S.T.C. Paignton Athletic & Social Club, Brixham Road, Paignton, Devon. 7.30 p.m.
13 Hull S.M.E. Life on the fish dock. Talk by K. Nicklas.
14 Polegate & District M.E. Club. Shipbuilding in Australia talk by Ron. Draper.
15 Ickenham & District S.M.E. Ickenham Festival all day running. Rear of Coach and Horses, Ickenham. 10 a.m.-6 p.m.
15 Milton Keynes M.S. portable track, Little Horwood Manor, Little Horwood, Buckingham. 2 p.m.
15 Birmingham S.M.E. Muscular Dystrophy fete at Illshaw Heath.
15 North London S.M.E. Visit to Colney Heath by Harrow & Wembley M.E.S.
15 St. Albans & District M.E.S. Ashfield School, Bushey. Loco meeting.
15-16 Guildford M.E.S. Miniature fair exhibition and model traction engine rally, 6 p.m. 16 July, 10 a.m.-6 p.m.
15-16 Bristol Soc. of Model & Experimental Engineers. Traction engine rally at Ashton Court, Bristol.
15-16 N. London S.M.E. Traction Engine Rally — Redbourne.
15-16 Bristol S.M.E.E. Traction engine rally at Ashton Court. M.E. exhibition and portable track. 11 a.m.-6 p.m.
16 Nottingham S.M.E.E. Open day — all clubs welcome.
16 Peterborough S.M.E. Public running.
16 Romney Marsh M.E.S. Portable track at Ashford Aeromodellers Rally. 12 noon.
16 Norwich & District S.M.E. Public running from 3 p.m. onwards at Eaton Park track.
16 Malden & District S.M.E. Visit from Kingston Toy Library (mentally and physically handicapped children) to the society.
16 The National 2½ in. gauge Association. Rally Midlands at North Birmingham.
16 Portsmouth M.E.S. Family day — Thames trip.
16 Harrow & Wembley S.M.E. Public running.
16 Bedford M.E.S. Public open day.
16 Worcester & District S.M.E. Waverley Street, Dighs, Worcester, 2.30 p.m. Public running day.
16 Harrow & Wembley S.M.E. Public running Roxbourne Park track. 2 p.m.
16 King's Lynn & District S.M.E. Public running. Walks track, London Road, King's Lynn. 2-5 p.m.
16, 30 Hull S.M.E. Track day at Goddard Avenue.
17 Peterborough S.M.E. Club night.
17 Leicester S.M.E. Every Monday night until the end of August. Track at Abbey Park, Leicester.
17 E. Sussex Model Engineers. Fred Honeysett's chat night. Library extension, Robertson Terrace, Hastings. 7.30 p.m.
18 Chesterfield & District M.E.S. General meeting. Bryan Donkins.
19 Cannock Chase M.E.S. Meeting Lea Hall Club. "Bring and Buy". 7.30 p.m.
20 Nottingham S.M.E.E. Official opening of the new workshop. Exhibition of work in land, members' slides, demonstration of lost wax casting.
20 Leyland, Preston & District S.M.E. Meeting at Roebuck Hotel, Leyland, at 8 p.m.
21 Romford Model Eng. Club. Track night.
21 Rochdale S.M.E.E. Springfield Park. Mr. J. Lancashire — Lost Wax Casting.
22 E. Sussex Model Engineers. Portable track at Hastings Carnival on promenade, adjacent pier extension, sea front, Hastings.
22 Chesterfield & District M.E.S. Sid's day. Track — Hady.
22 Wigan & District M.E.S. Meeting.
22 West Riding Small Loco Society. Efficiency trial and barbecue — full details next month.
22 Malden & District S.M.E. Malden families steam and chips night.
22 St. Albans & District M.E.S. Harold Wood School, St. Albans, loco meeting.
22 Nottingham S.M.E.E. Celebration of 21 years at Valley Road. Grand parade of club locos and traction engines.
22-23 Lambeth Country Show. Brockwell Park, Herne Hill SE24.
23 Bristol S.M.E.E. Public running at Ashton Court Track, 11 a.m.-6 p.m. Also club visit to Whitchurch Cardiff M.E.S. track.
23 Ardeer Recreation Club, S.W. Scotland. M.E. section.
25 Romney Marsh M.E.S. Track meeting at Rolfe Lane, New Romney. 6 p.m.
26 Norwich & District S.M.E. Informal gathering at Eaton Park track from 7 p.m. onwards.
26 Bristol S.M.E.E. Club meeting at The British Rail Staff Association Club, The Incline, Temple Meads Station. 7.30 p.m.
26 S.M.L.S. 2-5 p.m. The railway will operate.
26 Harrow & Wembley S.M.E. Track meeting Roxbourne Park track 7 p.m.
27 Hull S.M.E. Bits and pieces of models under construction.
28 Hereford Live Steamers. 8 p.m. at Bulmers.
29 Southampton & District S.M.E. Coach trip to Bristol track.
29 Bristol S.M.E.E. Club visit to Southampton M.E.S. track.
30 Colchester S.M.E.E. National 2½ in. gauge Association: National Rally, 10.30 a.m. to 6.30 p.m. Clubhouse and track, old allotments, off straight road, Lexden, Colchester.
30 Harrow & Wembley S.M.E. Public running Roxbourne Park track 2 p.m.
30 Guildford M.E.S. Public open afternoon.
31 Peterborough S.M.E. Club night.
31 Willesden & W. London S.M.E. Track safety — M. Saytch.

WILL YOU ENTER NEXT YEAR'S

HOT AIR ENGINE COMPETITION?

READ PROF. D. H. CHADDOCK'S REPORT IN MODEL ENGINEER'S 5 MAY ISSUE

Post Bag

The Editor welcomes letters for these columns. Pictures, especially of models, are also welcomed. Letters may be condensed or edited.

Enlarging the Myford

SIR.—I was interested in the letter from Mr. K. Birkby (p. 45, 6/1/78) which gave rise to long trains of thought about trends in model engineering, large scale locomotives—7¼ in. gauge and larger which are hardly models but examples of fairground engineering—and the inroads of commercialism into our hobby. Eventually I got back to the actual subject matter of the letter, part of which takes us, willy-nilly, into the realms of commerce. Mr. Birkby writes first about the Pools horizontal bench miller which was first described in *M.E.* as nearly as I can recall in the 'thirties. There was nothing original or outstanding about it, in fact it was a rather dreary machine (if one is permitted to use such a term of a machine) which gave up and died.

What interested me more was Mr. Birkby's plea for Myfords to give up the "old 3½ in. standard" and to increase the size to 4½ in. and he concluded by writing: "One wonders if it has ever occurred to them to change all this." I am not privy to the deliberations of the Myford firm but I imagine that they give a great deal of thought to their products and if they could, with advantage both to themselves and the purchasers, increase the centre-height of their lathes, they would do so. Why don't they? A change from 3½ to 4½ is an increase of 28.8 per cent but one cannot simply increase the centre-height and leave everything else as it was. If the character, stiffness and durability of the lathe is to be maintained, the machine would have to be increased by substantially the same percentage in all its dimensions. The distance between centres would not have to be increased but someone would complain about a 4½ in. lathe taking only 19 in. between centres and the extra 5 in. of bed would not amount to much.

The weight of materials would increase by the cube of 1.286, i.e. 2.125 times, and the machining times would increase in proportion to the area to be machined, i.e. by the square of the scale, equals 1.625 times. Whilst I have available no cost breakdown of a comparable machine, a precision-built lathe such as the Super-7 would probably break down into: labour plus overheads 70 per cent, and material and B.O. items 30 per cent, and if these are now multiplied by the scale factors we get:

Loaded labour	70	× 1.625	=	113.75
Materials and bought out items	30	× 2.125	=	63.75
	100			177.50

which indicates that the 4½ in. lathe made to the same standards as the 3½ in. is going to cost 77½ per cent more. This figure might be adjusted down a little because I have worked on crude factors—fitting and assembly have been lumped in with machining but they would not increase to the same extent and they might be subject to a lower overhead. In spite of any savings that might be made I would expect the cost to be increased by at least 50 per cent. On top of this there would be a complete new set of tooling which, at a conservative estimate, would cost about £50,000, all to be amortized over, says, five years' production.

Such an increase in cost would decimate the sales which would, in turn, further increase the cost and selling price. All for what? There are several 4 in. to 5 in. lathes, of variable quality and usefulness, available on the amateur market and these, generally, do not have gap beds so their maximum swing is no more, and frequently less, than a 3½ in. gap bed lathe which will turn the driving wheels of any locomotive which would fall into the category of "model engineering"—which is more than could be said for some of the larger machines with a bottom speed of 100 r.p.m. If this is not enough we could be entering the field of commercial work and there are plenty of commercial lathes to choose from.

Perhaps Myford have thought about it!

New Milton, Hants. Geo. H. Thomas

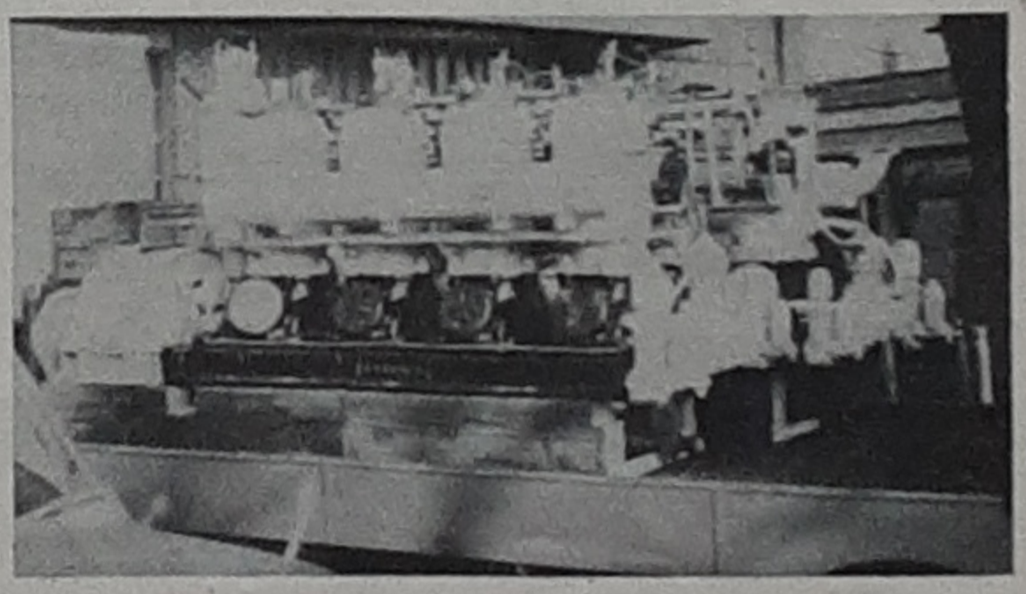
Gardner engines

SIR, — In view of the recent correspondence concerning Gardner engines perhaps the enclosed photograph may be of some interest. It shows a pair of T4 Semi Diesel engines manufactured by Gardner in 1927. These engines were removed 45 years later and presented to Messrs. Gardner for preservation. The vessel served during the war as a Contraband Control Boat.

I became connected with the vessel round about 1950 when it was laid up in Dartmouth Harbour. The engines were in a pretty poor state but even in that condition the trip from Dartmouth to the East Coast was made without incident although rather slowly. The engines were overhauled and the yacht then made many successful voyages, principally to the Baltic and the Scandinavian waters. A trip was once made from the East Coast right up the Rhine to Switzerland at Basle. At this time the River Rhine was 2 metres above the normal level and at some spots it took an hour to make one mile over the ground. It took ten days to reach Basle from Rotterdam but only four days to return. During the last trip to the Baltic trouble appeared. There was a compressor mounted at the forward end of the crankshaft to supply the air for starting and manoeuvring. The engines were cooled with raw salt water and after 45 years of this treatment corrosion of the compressor water jacket caused water to leak into the compression space: this allowed the water to mix with the main bearing oil. Compressor was isolated and the cooling water to it cut off.

The engines were removed after this incident because it was impossible to tell when a similar thing might happen in another and more important part of the engine. A pair of six-cylinder modern diesel engines with superchargers and reduction gears were installed. These engines give twice the power for one quarter of the weight, but I am certain they will never last 45 years.

Brentford. D. W. E. Kyle



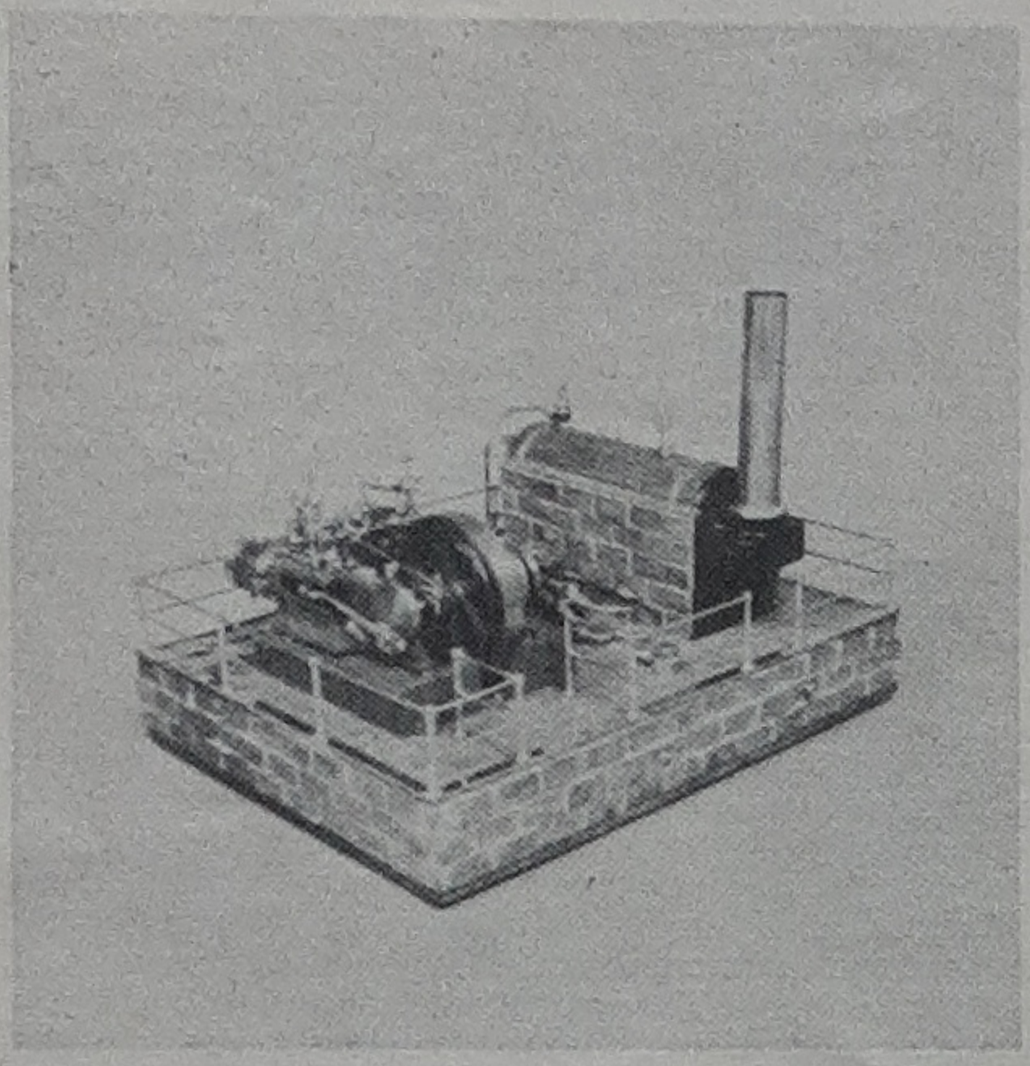
Tangye Engine

SIR, — I wonder if you might be interested in publishing a picture of a Tangye Mill Engine, Stuart Turner Boiler Feed Pump and Boiler that I have recently completed. It's my second model, the first being a Stuart Turner Beam Engine.

The whole is a working unit, gas fired with a cold water storage tank mounted within the base. The walls are of Westmorland slate cut to scale while the flooring is made from 2 cm.^{2} ceramic tiles that have an identical appearance to quarry tiles.

I think I should mention that the idea of mounting the boiler assembly below floor level, thereby avoiding it dominating the engine, came from a recent contributor to *Model Engineer*, Mr. P. Cue, whose model of a Stuart Turner Beam Engine appeared in a September 1977 issue. Also, like Mr. Cue, I am indebted to George Watkins' book *The Stationary Steam Engine* for many details.

Edinburgh. Tim Brameld



Dividing

SIR, — I would like to submit a simple method I use for dividing where extreme accuracy is not needed. The only requirement is a graduated handwheel on the leadscrew, and a QC gearbox is a time saver. Set the lathe to cut the same pitch as the leadscrew then, say, ⅛ in. pitch will have 125 grads on handwheel. Take up the slack turning by hand and for perhaps 25 grads then every 5 on the handwheel will give the divisions, even odd divisions can be done by a simple calculation.

No. divisions, say, 8 holes on a cylinder cover,

$$\frac{125}{8} = 15\tfrac{5}{8}$$ grads, ⅝ division is simple enough to estimate.

I use this system on my metric V10 and find it accurate enough for most work.

N.S.W., Australia. N. Chisholm

Ball Handles

SIR, — As one of the readers who encouraged Geo. Thomas to write his articles on ball handles I anticipated his recommendation by making Radford's "Spherical Turning Device" (*M.E.*, 4 October 1966). It really is a beautiful tool.

If other novices in milling are doing the same there are one or two points to watch. There are a few discrepancies between the words and the music. The tool hole is given in the text as being 3/16 in. from the top of the toolholder, whilst the drawing appears to show ¼ in. 3/16 in. works out all right. The boss on the back of the main head looks right at 1⅛ in. and not the 1¼ in. as in the text, and the counterbore in the head for the spindle is, of course, ⅞ in. dia., and not 1⅛ inch.

I didn't have a chance to incorporate all Geo. Thomas's modifications but not having any C.I. I milled up the body out of 1⅜ in. M.S. with a tongue for the four-tool turret and put in a couple of ¾ in. long brass bushes, and two oil nipples to keep the swarf out of the oil holes.

In milling the 60° slides if you have to make or buy a cutter make sure this has a long enough cutting edge to give at least a 5/16 in. sloping face. If you, like me, haven't done much milling before, do read Arnold Throp's *Vertical Milling in the Home Workshop*. It is quite applicable to lathe milling, especially the last chapter. It would have been better as chapter 2 as it really is essential to emphasise that you do need a proper chuck for your cutters, especially the dovetail cutter. These special chucks are expensive but I found a set of Arrand milling cutter holders with a draw bar did the job well. (Tip from Geo. Thomas: don't work on the bottom and the slope face of a dovetail cutter on the same cut.) I didn't fit a gib strip. This is not a tool which gets a lot of wear, but if any does develop I can fit a gib later.

When offsetting the toolholder 5° in the four-jaw chuck when screwcutting the ½ in. (by 26 in my case) thread, packing fore and aft isn't really rigid enough. Make a 5° brass wedge and cut it into two pieces.

I can't see the point of finally putting a stop in the tool hole and certainly 2 BA won't thread into a 3/16 in. hole so I left the hole blind. It can be finished with a D bit or a machine reamer. I didn't braze the spindle into the head or the toolholder into the slide. Loctite will do.

The drilling of the head and slide together is not for me. Drills wander and I spoilt a couple of bits proving it, so I changed to boring. Twelve months ago I wouldn't have dared, but since then I've made Geo. Thomas's boring tool holders which I use with my Eclipse boring tools, now properly sharpened and set at the correct height with his centre height gauge — what a difference! I made bushes to guide the drills and taps when finishing the leadscrew nut.

Tapping, or preferably screwcutting, the hole in the head for the leadscrew nut only ¼ in. deep (I used 5/16 in. by 40) is tricky but there is no reason why the hole should be blind. Go right through and machine the tail of the nut away when you do the back of the head. Incidentally don't be tempted to drill any of these holes in the head until the slide grooves are finished or the milling will probably go awry.

One of the things darkest Dorset couldn't produce was a couple of ⅝ in. red fibre washers but I did have a stub of Tufnol from which two were parted.

I used Geo. Thomas's method of sharpening the tool with a *nett* 20° rake and the results on the first two balls — the handle for his quick action hand rest — were excellent. I sharpened the other end of the tool to a *nett* zero rake for brass in case I ever take up pawnbroking. Incidentally the castings for the hand rest are very much oversize but unless one takes off the excess metal the weight goes up considerably. You don't need a dovetail cutter for the two expanding strips of this tool. These can be machined on the vertical slide — if necessary with an angle plate and a machine vice — with a fly cutter or milling cutter. By the way, the dimension 3 27/32 in. on the shaft of the Q.A.H.R. should be 3 23/32 inch.

After these few weeks of toolmaking perhaps I can now get back to making clocks!

Dorchester. Robert Saunders

Air Compressors

SIR, — I read the article in "Jeynes' Corner", 3 February issue, with interest. However, I feel that he could perhaps have described the two different types of compressors better if he had called them rotary and reciprocating. He gives the impression that the only rotary air compressor is the sliding blade type. This is quite incorrect as there are many different types of rotary machines. To name some:

The Rootes compressor with its lobed twin rotors, the Lysholm which is a slightly different version of the Rootes and even the Imo screw compressor, not to mention the most up-to-date rotary screw air compressors which are being manufactured and sold by well-known firms in the field such as Broom & Wade and Atlas-Copco, etc. (usual disclaimer). These have two rotors which are very like meshing helical gears and their advantages are that they are very efficient and quiet running, although they are slightly more expensive to purchase than their older type counterparts, the reciprocating (piston and cylinder) type which quite literally thunder away. I have just purchased and installed one of the rotary screw machines in the factory in which I am employed. Its output is 180 cubic feet of air per minute at 150 pounds per square inch pressure and it runs relatively quietly at about 70 db of noise level. The machine which I purchased six years ago and is installed in the same compressor house is a reciprocating type producing 150 c.f.m. at 150 p.s.i. and it runs at a noise level of between 90-95 db. The "modern" type of rotary screw machine has been sold on the U.S. market for quite some time now but it is just beginning to gain popularity here in this country. I would like to end by saying that the field of rotary air compressors is a very large one.

Edinburgh. S. Blackley

Ted Jeynes Replies

Having regard to Mr. Blackley's comment, as he remarks, possibly it would have been more correct to have said "Rotary and Reciprocating", but when writing, I had in mind the most likely types to be found in the model engineer's workshop. The firm I worked for handled Broom & Wade compressors.

"Jack"

SIR, — Having read the article in *Model Engineer*, 20 January, by Mr. Perryman entitled "Jubilee Steam and Craft Fair", I should like to correct his information regarding the locomotive "Jack".

"Jack" is a model of an 18 in. gauge outside frame and cylinder 0-4-0 with tank locomotive, not an 0-6-0 2 ft. gauge contractor's locomotive.

The prototype was built by the Hunslet Engine Co. in 1898, works No. 684, and with its sister "Gwen" (Hunslet 1909-1920) worked the 18 in. gauge railway of John Knowles of Woodville, near Burton-on-Trent. When that ceased operations in 1958 "Gwen" went to America and "Jack" is at present stored awaiting restoration and eventual display. The model was built by Mr. Roger Marsh of Hinckley in 1967 and is ¼ scale, not ⅕. The large brass dome is not surmounted by a "Salter" safety valve, that is in fact a lubricator or should be. The "Salter" safety valve on the model is mounted on the firebox.

The prototype does have dome mounted safety valves, but these are of the pop variety.

Sutton, Surrey. Paul Ingham

Aveling & Porter No. 807

SIR, — I am a regular reader of *Model Engineer* and I am at the moment between projects. I am considering building a 3½ in. or 5 in. gauge model of the Aveling & Porter 0-4-0WT 1872 No. 807 now preserved and housed at the London Transport Museum, Syon Park, Brentford.

I have written to the Curator, Mr. Day, and spoken with Mr. Braithwaite, his assistant, to ascertain if there are any works drawings in existence for the locomotive. I have also written to Messrs. Aveling & Barford of Grantham with the same request. The only information I have had to date is that there are no known drawings available, and it appears that a fair number of people have, and still are, making enquiries for the details.

Bearing in mind the apparent popularity of this loco, it occurs to me that someone may perhaps know of the existence of any drawings or may know of any readers who have prepared drawings or photographs and actually built this in a model. Mr. Braithwaite tells me there will be no difficulty in obtaining permission to photograph and measure the loco and this I may eventually have to do.

Can anyone please help me with any information you may have or any suggestions, or sources of information that will help me to get started on this project.

Horsham, Sussex. T. H. Hawkins

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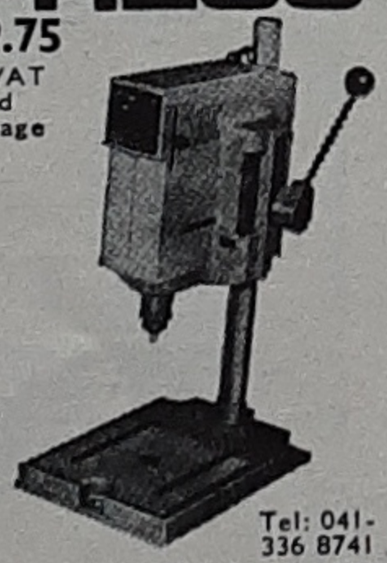

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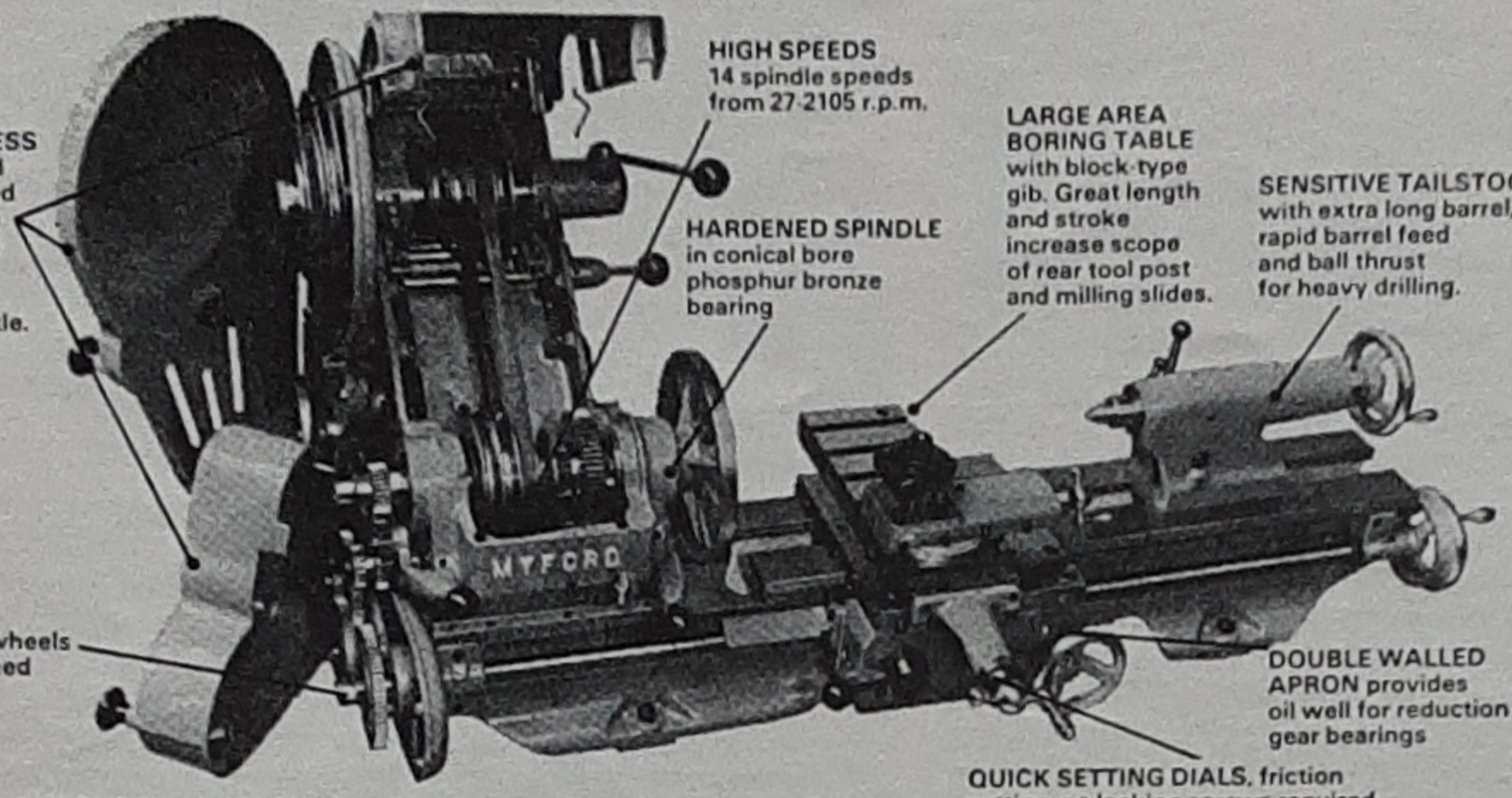
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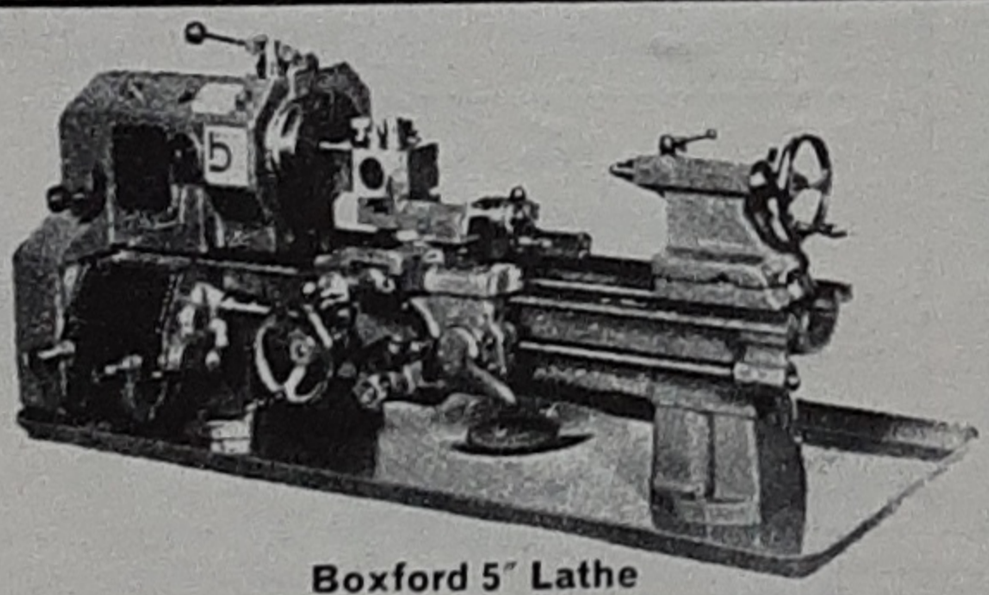

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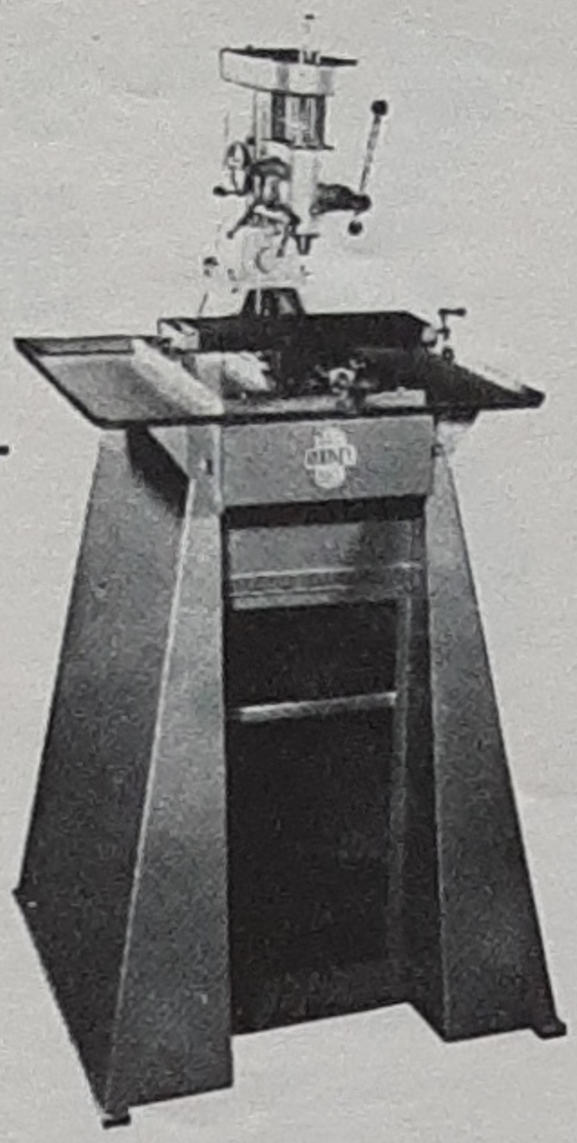

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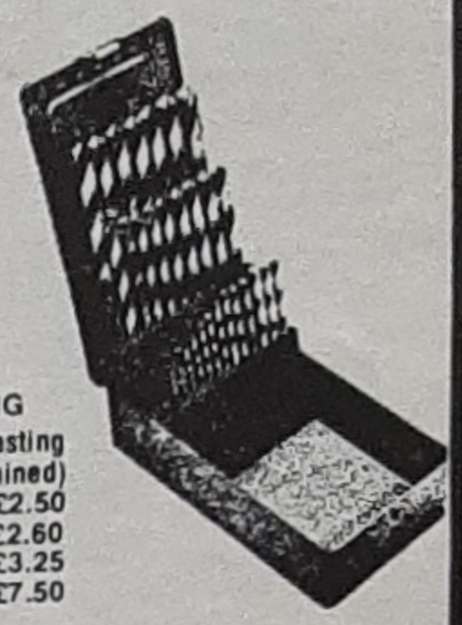

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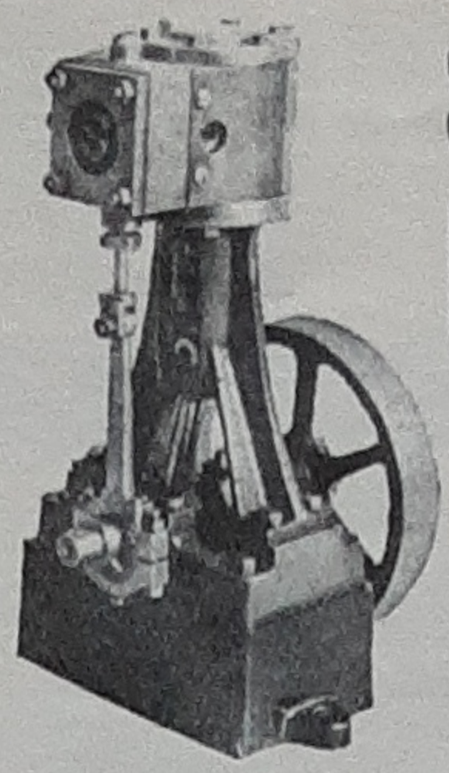

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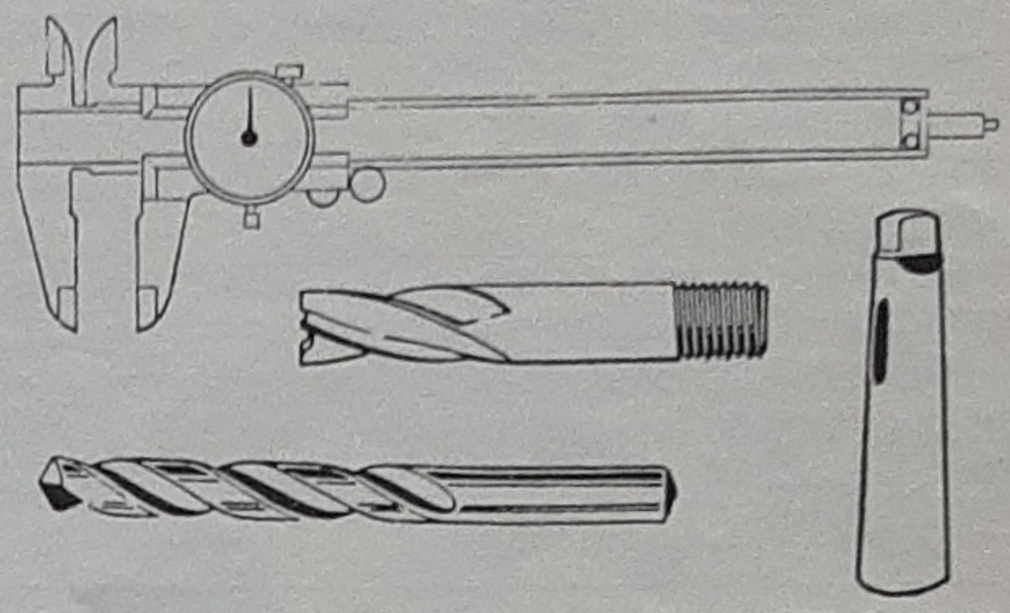

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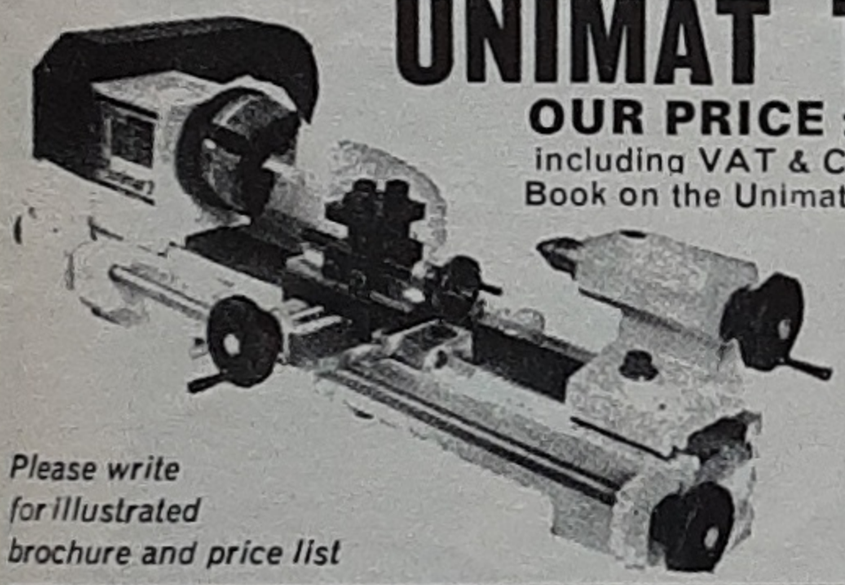

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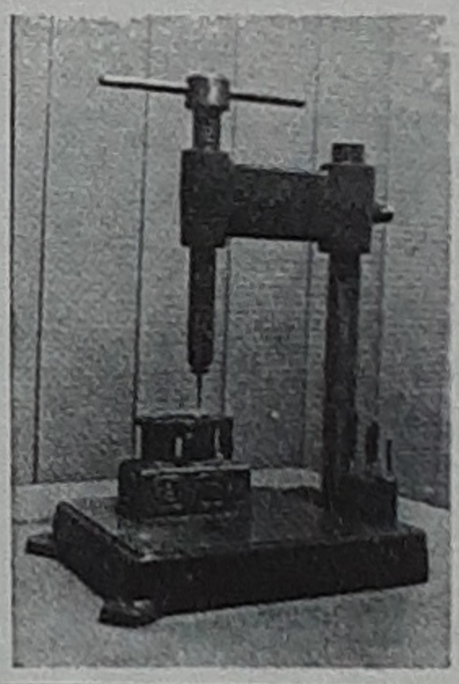

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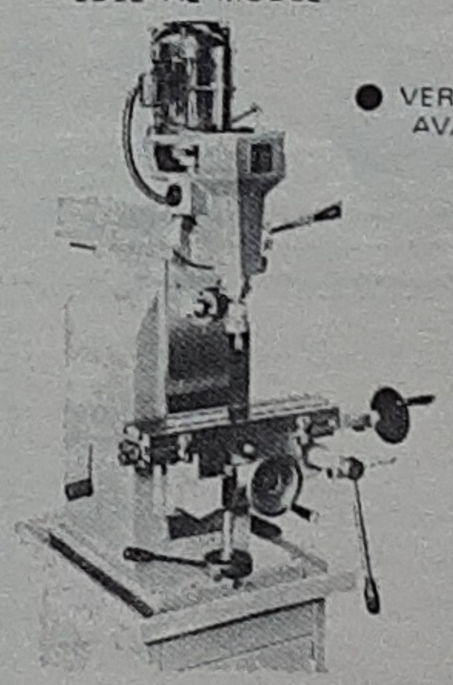

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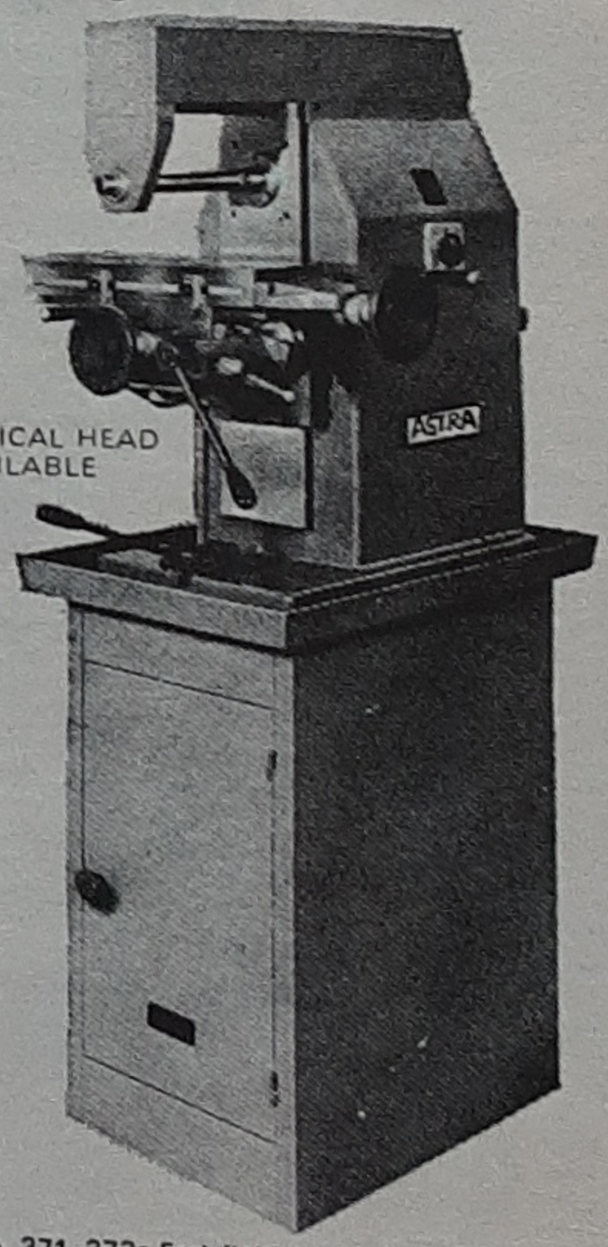

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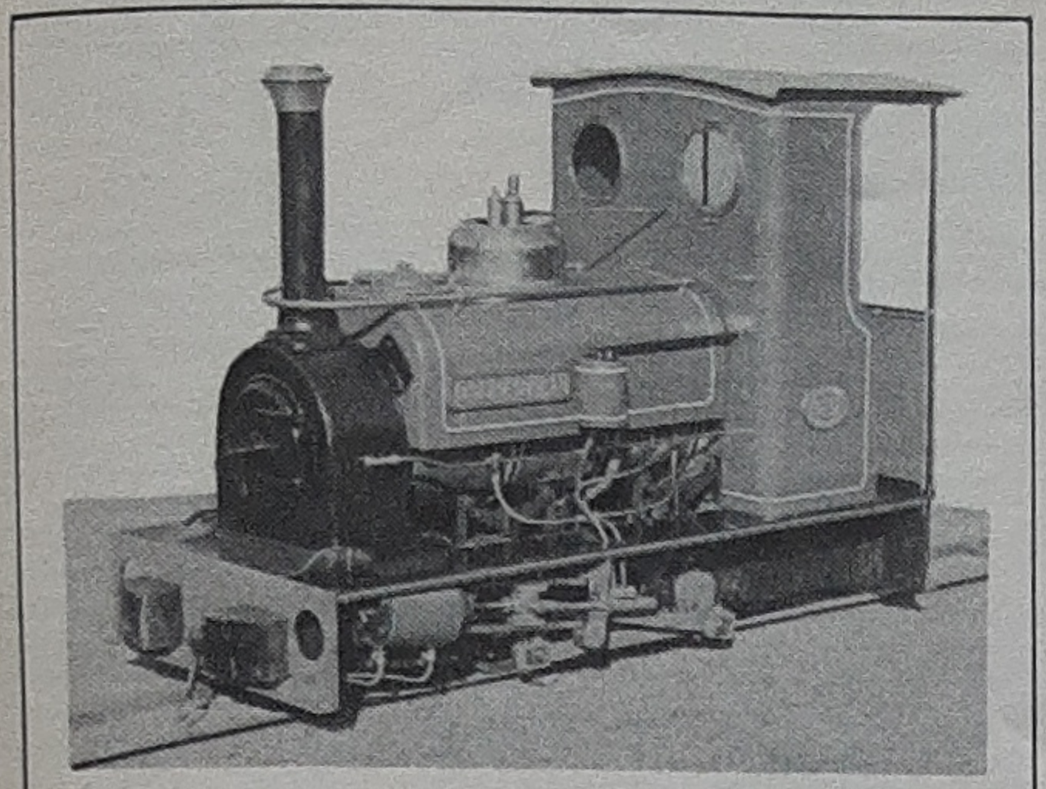

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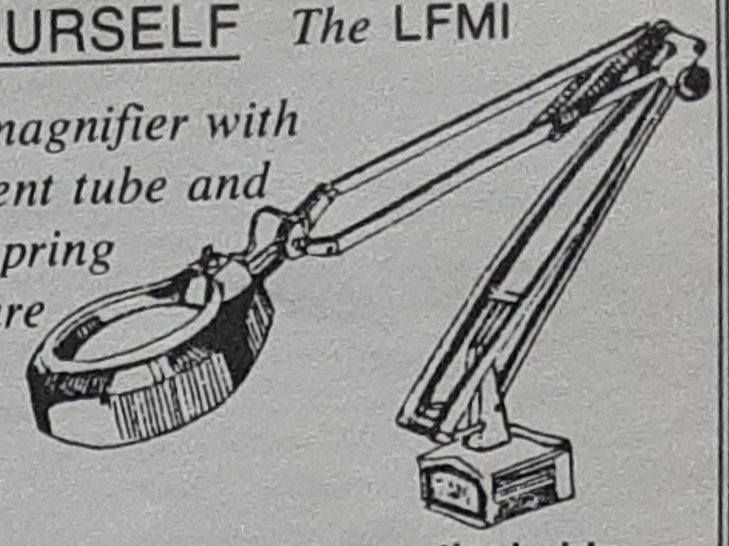

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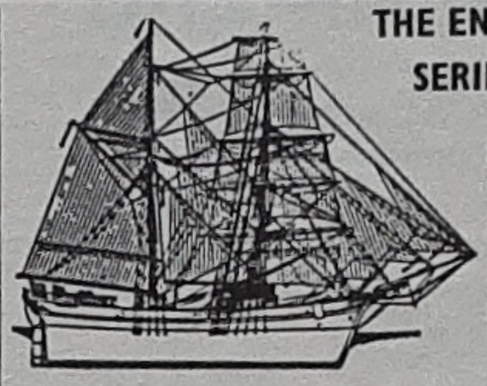

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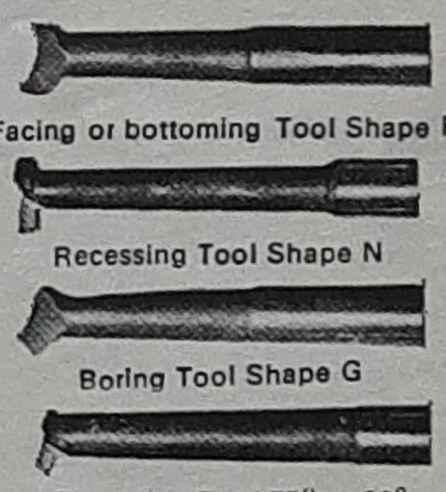

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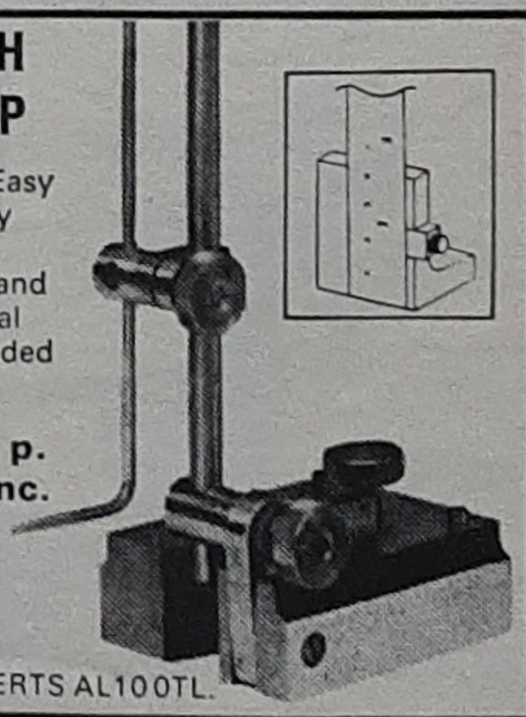

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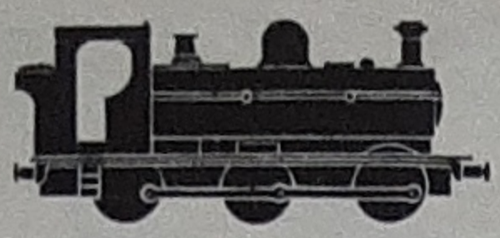

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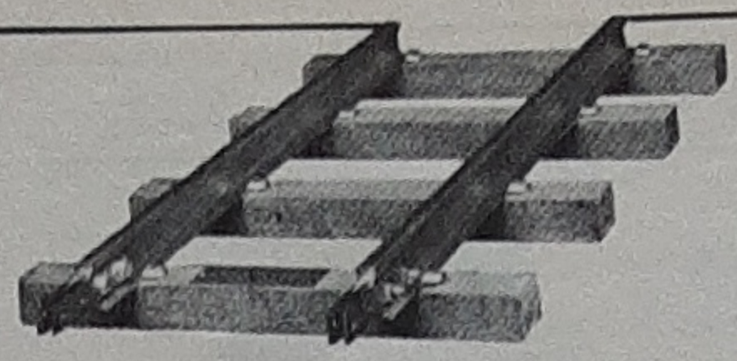

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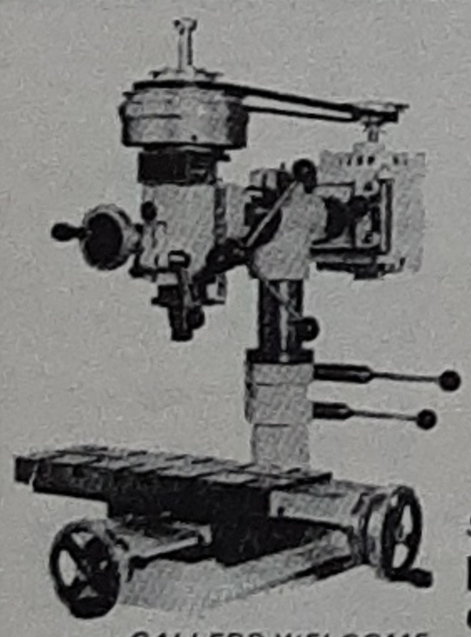

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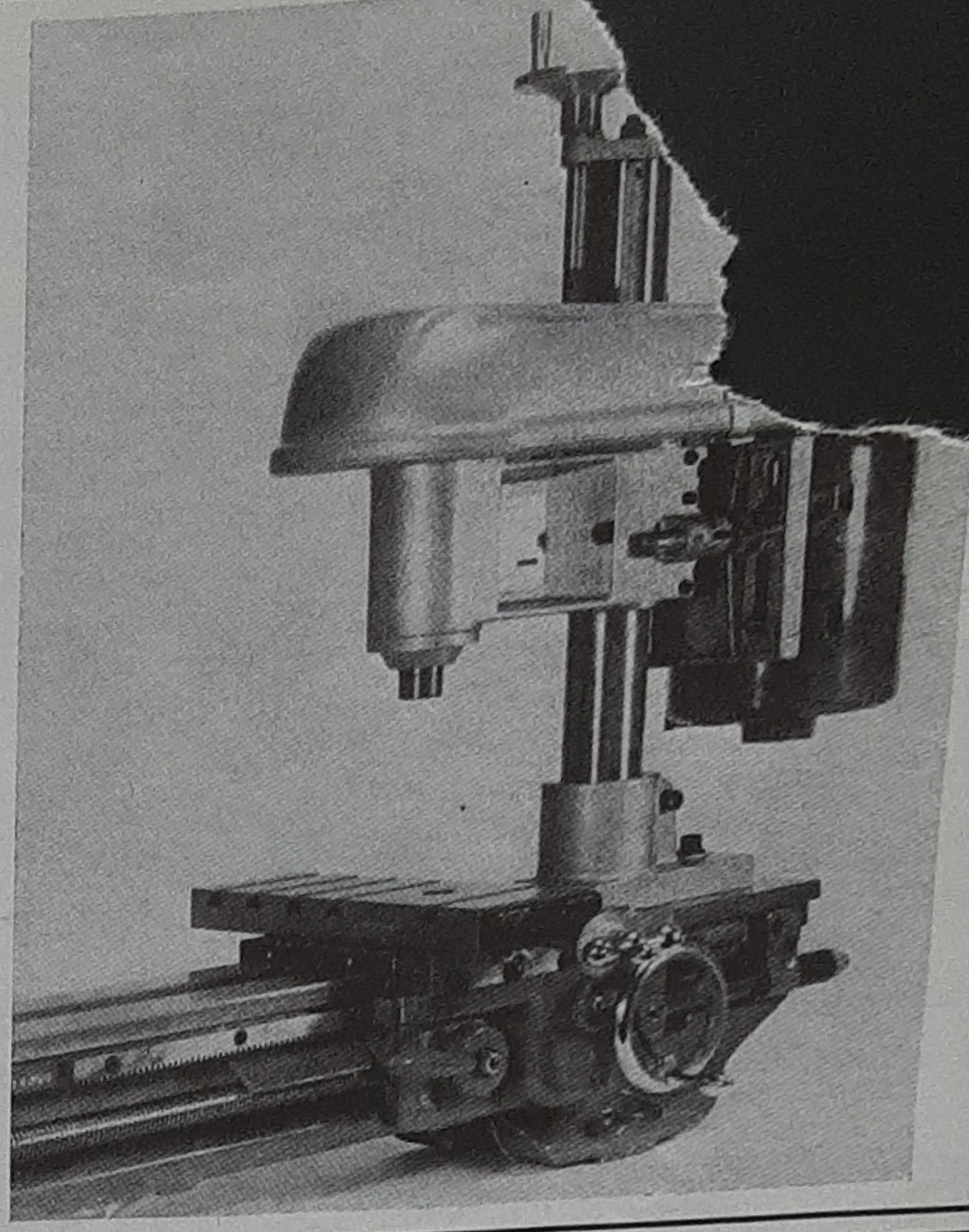

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